To Matthew Baillie Esq.r M.D.

From his grateful friend

The Author.

ANATOMY

OF THE

HEART, CRANIUM, AND BRAIN,

ADAPTED TO THE PURPOSES OF THE

MEDICAL AND SURGICAL PRACTITIONER;

TO WHICH IS ADDED, IN NOTES,

OBSERVATIONS ON THE LAWS OF LIFE AND SENSATION.

BY

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SECOND EDITION, MUCH ENLARGED.

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COPY OF A LETTER

FROM

THE RIGHT HON. SIR JOSEPH BANKS,

BARONET AND K. B.

PRESIDENT OF THE ROYAL SOCIETY, &c. &c. &c.*

TO DR. RAMSAY.

Soho Square, Jan. 29, 1813.

MY DEAR SIR,

I RETURN you my best thanks for your obliging present of the valuable second edition of your Anatomy of the Heart and Brain: I have perused it with much pleasure, and I give you abundant credit for your most laudable attempts to destroy the baneful system of materialism, and to explain the hitherto incomprehensible mixture of mortality and immortality of which we are composed.

How it can have happened that an extended knowledge of any kind could have led to infidelity, is to me wholly unintelligible: every investigation of nature, and even of art, must lead to a conviction of the certainty of the existence of a Power capable not only of creating, but of causing created beings to continue their species. Religious men are always terrified at the idea of laymen having any superior knowledge, lest they should use it in calling in question those parts of every religion

* The Gentlemen who have honoured the Author's Prospectus with their names, as promoters of his System of Anatomy, deeming the publication of the Letter of Sir Joseph Banks, of the highest consequence to its moral influence with the world—this object alone could have induced the Author making the request; and this circumstance only has prevailed with Sir Joseph Banks to permit its appearance, as it dropped from his pen in confidence. Thus, this illustrious personage, has given the world an additional proof of his relinquishing his own inclinations, where the good of others is concerned.

which depend upon a sacrifice of reason to faith ; hence it is that philosophers have been too much upbraided with the crime, as it is called, of unbelief, when in fact they are better acquainted with the works of their Creator, and more impressed with the certainty of His infinite wisdom, mercy, and benevolence, than any other set of men.

To you, my good Sir, we are deeply indebted for weaving into the texture of Anatomical Studies, opinions deduced from facts, which cannot fail to give to the minds of your Pupils a disposition to recollect their Creator, and to adore his benevolence, in the course of those studies, which are to make them able to be themselves benefactors of their species. You are, as far as I know, the first Anatomist who has introduced into his Lectures any considerable notices of the wisdom of God in his works of creation; may your example be followed, and thus may the minds of our youth be framed in a better disposition, and rendered more useful to their neighbours as well as to themselves, than has been the case with the generation now making their exit from the regions we have been, and are yet permitted to enjoy.

I beg, my Dear Sir, you will believe me,

Your obliged and faithful

Humble Servant,

JOSEPH BANKS.

TO THE RIGHT HONOURABLE

SIR JOSEPH BANKS, K. B. & BARONET,

PRESIDENT OF THE ROYAL SOCIETY,

&c. &c. &c.

THE FOLLOWING WORK IS INSCRIBED,

WITH SENTIMENTS OF THE HIGHEST ESTEEM AND RESPECT,

BY HIS MUCH OBLIGED,

AND VERY HUMBLE SERVANT,

THE AUTHOR.

INTRODUCTION.

THE rapid sale of the first edition of this Work, and the approbation with which it has been received, encourages me to present the public with a second impression.

Plan of the Work.

The plan followed in this Treatise, I originally adopted in my lectures in Surgeon's Square, Edinburgh; and since that period, I have extensively prosecuted it in the Colleges of New York, Dartmouth, and Brunswick. In these American seminaries I successively taught, by invitation, when I visited that Continent, with a view of investigating the human frame, under the varieties of climate, government, and police.

In this volume are brought into view the parts composing the Brain, and their relative connection with each other, as well as remote organs more immediately connected with it, so indispensable to the practitioner. By this means the anatomy, physiology, and practical ideas, of each department of the system, will be brought before the physician or surgeon in one connected scheme. The next volume will display the minutiæ of the component parts of the Head and Neck, for the improvement of the Student.

This method will be observed in the prosecution of the work, that it may answer the purposes of a guide to the practical anatomist, and in some degree a substitute for dissection. As we proceed, directions will be given in notes, not only respecting the steps to be taken in the course of dissection of the human body, but likewise for preserving the various parts in a moist and dry state.

The design of the work may be understood by the following observations :

Plan of the Plates.

When we contemplate the Brain, we cannot well avoid speaking of its arteries and the heart; these again lead us to the laws of muscles, and their phenomena connected with Intellect. These circumstances have led me to add to this edition, plates and descriptions of the general structure of the heart and arteries, with such remarks as rise out of their phenomena. Plate I. affords views of the Heart, as it appears *in situ* in the cavity of the thorax. I trust, too, that the action of the valves of that organ, the means by which young men may demonstrate this action to their own conviction, as well as the intentions of the synchronous motions of the cavities of that viscus, may be easily understood by the help of this plate. Plate II. not only leads to a knowledge of the entire head, but in Fig. 4th of the same plate, an attempt is made to view the various parts of the Brain, and its containing parts, as through a transparent medium, that we may, from external and familiar objects, transfer our notions to those internal, which are more rarely recognized. Thus, in Plate III. Fig. 1st and 3d, a notion of the muscles, external vessels of the Head, its bones, and the vessels of the Brain, may be understood in their relative situations; and in Plate II. Fig. 4th, the outline of the bones is preserved, while the internal parts are supposed to be seen on one vertical plane, so as to show their relative situation to each other, and to the containing parts, while the corresponding external objects are given in Plate III. Fig. 1st and 3d. By means of these plates, the effect of injuries may be easily understood. Thus, a ball penetrating the centre of the Eye, will pass through the middle lobe of the Brain, as represented, (Plate II. Fig. 3d, t), while the effect of lateral injuries is seen at one view, by Fig. 4th of the same plate. From Plate IV. to the end of the representations, the figures afford regular views of the series of appearances which occur in dissecting the Brain. In Plate VII. the dissected plates commence; where the hand separates by the

thumb the left hemisphere (a), and by the fingers the right is pressed backward, exhibiting the falx (h), the right hemisphere and the corpus callosum of the left side being thus brought into view. By lifting Plate VII. an imitation of real dissection is attempted. The hemisphere being thus removed, and Plate VIII. brought into view, the same corpus callosum appears in continuity with the centrum ovale; the right hemisphere and falx retaining their place. Upon lifting Plate VIII. we remove the ceiling of the left lateral ventricle, the bodies of which appear as one plate, (on viewing Plate IX.) but this really comprises four plates; each of which contains the bodies which are separated from each other in the course of dissection. All the figures are represented half the diameter of the human adult, which seems to answer the purposes of larger figures, without incurring the expence and bulk of such works. I may observe that the objects are taken from human subjects of the larger dimension, as I found that a rigid adherence to the common size failed in being sufficiently expressive. Side-notes point out the leading subjects of this Essay, and notes at the bottom of the page contain such notions as are not immediately connected with the descriptions.

Apology.

In an undertaking, embracing so extensive a range of objects, and their relative connections, so necessary to practice—so likely to form a taste for investigation and accuracy in the Student,—I may have occasionally erred; but no pains has been wanting on my part, to render these plates a basis of practical inference.

I am convinced, that the mode adopted, in the manner of description, may often appear tedious and uninteresting; but this, as nearly as possible, assumes the style of demonstration, which my pupils have approved, every thing mentioned being subjected to the test of the senses. When describing any figure, the reader may continue to consult the one immediately mentioned, as the object of his attention; as I have endeavoured, wherever a figure is changed, to mention the one referred to. No representations can fully compensate for the absence of objects represented; but

I trust, that, with preparations before the student, thrown into the attitudes here attempted, he cannot fail to comprehend their anatomy.

As few artists can adhere so strictly to those minutiæ on which anatomical works become chiefly valuable, the figures are not only drawn from nature by my own hand, but I have likewise etched them myself, under the superintendence of Mr Robert Scott, engraver, Parliament Square, Edinburgh.

If this edition is improved as engravings, I have to acknowledge the dexterous and delicate hand of that gentleman, as the cause of the finished appearance they now assume, which I presume is sufficiently elegant for anatomical purposes. I must in justice to Mr Scott observe, that such deficiencies as may appear in the work, as plates, derive this from the imperfection of my etching.

DESCRIPTION OF THE PLATES.

THE HEART AND ITS APPENDAGES.

General Notion of the Heart.

THE Heart of man is composed of four cavities. These may be enumerated in two pairs; one pair is named Sinuses (Plate I. Fig. 2d, g—Fig. 5th a), and these compose the roots of the organs named veins. The other pair is denominated Ventricles, (Plate I. Fig. 2d, l l,—Fig. 5th, f, c, d); these form the roots of the organs named arteries *.

* Fig. 2d is the outline of Fig. 1st. Fig. 5th is the outline of Fig. 4th; the œsophagus, trachea, and thoracic duct, represented in Fig. 4th, being removed in Fig. 5th. The sinuses or bags have auricular appendages; (h) Fig. 2d, is the auricle of the right sinus (g); (l) Fig. 1st and 4th, is the auricle of the left sinus (a) Fig. 5th.

In whatever period we view an animal being, we discover active agents, as a heart and arteries; or organs analogous to them. In the critical moment of conception, before other viscera are perceptible, a punctum saliens appears to us as a pulsating object, which directs and regulates the present state of the embryo, and gives being to its progressive and varying powers and faculties. Not only in the evolution during gestation do these organs which already have being give rise to succeeding existences of organization; but from the moment of parturition, to the latest period of human life, each period may be viewed as the basis of future stages. If I may be allowed the expression, every series of animal existence is a perfect whole; still, however, that which remains unfinished by one period, forms the rudiment, security, or platform of that which follows. From the state of these wonderful agents, and their vascular arborescence, we seem to trace all the varied phenomena connected with human nature. Even the mind of man, in a material state of existence, is actuated through the medium of corporeal organs, as the material instruments of the soul. We discover these promoting the growth and attachments of the child. They build up organs which give being to the functions and feelings of puberty. The genius and varied stages of maturity succeed. These same organs decay. New and corresponding modifications fill their place. Man is intended to advance from one period of perfection to another, as an intelligent and moral agent; and when the heart and arteries fail to actuate him as an animal, their physical offices, after mid-life, leave him at leisure to contemplate, more minutely, the nature and intention of his immortal being, through the same progressive medium of natural organs which affected the previous periods of life. The brain seems continually actuated through the medium of these primary agents; the state of which as physically induces solid and exalted ideas in old age, unexcited by vigour, sexual organs, and in possession of wisdom; as in youth we discover lively fancy, or ambitious froth, flowing

1st, The Sinuses of the Heart.

The Sinuses are cavities which receive the blood from the veins of the body and the veins of the lungs, and which transmit their contents to the Ventricles.

from the presence of vigour and sexual organs, in the absence of experience. I must be understood to consider these objects as an anatomist, so far as mortal and changing organs have an influence in promoting the phenomena connected with an immortal essence.

The Heart and its vessels seem to derive their powers as acting organs from their muscular economy. From the vitality of these, on which the varied modifications of action depend, all physical phenomena seem to derive their origin, whether we contemplate life, growth, health, disease, the varied talents of men, or the phenomena of decrepitude and dissolution.

The vitality of muscles would seem dependent on some superadded principle, which is continually applied to an inherent state of organization, which presents a capability or capacity, admitting of excitement by the various appropriate stimuli connected with animal being; for the vital organs, although continuing the same, instantly expire in the absence of the atmospheric and other fundamental agents; on the other hand, when the organs have accomplished their various stages, stimuli are applied in vain. Mortality seems to be a necessary termination of living organized bodies; the inherent capability or capacity for being excited, seems to suffer diminution by every pulsation the heart and vessels perform. The same aliment, atmosphere, solar and other influences, therefore, which excite living action, likewise promote the process of death; and those active external powers which administer to the living, precipitate the valetudinary and the dead to decomposition, again to form new and endless compounds. Life itself may really be deemed a living decomposition, of which the various stages of existence are periods, and death its termination, as an organized whole.

Muscular matter, from its influence on the nervous system, appears the acting agent on which the result of sensations depend. If heat, cold, light, or darkness, communicate certain actions to the vessels, which are taken notice of by the soul, through the medium of the nerves and brain, as objects of reflection—by whatever means these actions take place, must not the same mental conclusion follow? Mankind are naturally apt to confound ideas connected with sensation, which are operations of *soul*, with *soul itself*. Nothing seems a stronger illustration of the immutable nature of *soul*, than the mutability of *ideas*, or operations of *mind*, so far as they are connected with sensation. In this transitory state of existence, the *immortal soul* is informed through the medium of *mortal organs*, so far as sensation is concerned;—a single rash action, or inordinate thought, may, in an instant, subvert the economy of these organs, and then the profound mind shall exhibit the distraction and incoherence of the maniac. We startle at these awful results of morbid states of the heart and arteries, forgetting that the possession of understanding is only a consequence of another modification of the same organic operation. Would we expect, where a wise God is concerned, that one species of action should occasion its appropriate intellectual effect, and that another should fail in its corresponding consequence? We look with calmness and expectation at that state of organs, the action of which induces pleasure and a sane mind; but we startle when inordinate action induces its corresponding ideas. But both states prove to us the influence of corporeal organs (continually obnoxious to change) on the unchangeable intellectual principle which takes cognizance of these changes; and these phenomena are the true results of cor-

2dly, The Ventricles.

The Ventricles are those cavities which receive the blood from the corporeal and pulmonary sinuses, and transmit their contents by their appropriate arteries to the lungs and the body.

poreal function in the collected mind, as well as the unhinged understanding, both of which exhibit that intellectual phenomena which correspond with corporeal health or disease of this fabric, which composes the material instrument of the soul. We may therefore denominate muscular economy the physical basis of sensation, and such reflections of intellect as flow from such material operation. Hence the laws of *Religion* are the rules of *health* and *correct ideas*. The *healthful* and *sober* man, sees and feels things as they are, because the muscles of his heart and arteries are only excited when objects are present to excite them. But *disease* and *intemperance* induce a state of system, when the *legitimate* operations of muscles are *suspended*, and of their own accord they assume those actions (on which sensations depend) in the absence of exciting causes. On such occasions, the phantoms of clouds and darkness often occur in clear sunshine—light and flashes of fire are apparent when we are enveloped in the real gloom of night—various colours float before the eye of the valetudinary—nauseous tastes, ungrateful odours, confused sounds, and teazing feelings, distract and mislead the victim of morbid action, which have no existence but in the convulsions of imbecile muscular matter, which often fails, on the other hand, to be actuated by natural appropriate stimuli. Pleasant sensations are rarely experienced by a morbid state; pleasure is that action, depending on a state of system prepared for and dependent on the reception of physical stimuli. The notion of morbid strength, therefore, in the paroxysms of febrile and other maladies, seems very erroneous; as these actions are really the convulsive and involuntary struggles of unhinged nature, which never take place in health or strength. We discover in *articulo mortis*, that the individual has no power to effectuate voluntary exertions; but the muscles of the limbs of their own accord, contrary to will, contract with violence—the penis is often suddenly erected—the muscles of the abdomen, rectum, and vesiculæ seminales expel their contents, &c. These seem not the consequences of strength, but the results of expiring muscularity, which never takes place in a state of strength, but in debility. The same observation holds respecting the morbid action of the heart and arteries. The heart and arteries of a healthy man contract gently on the application of their contents. Suppose this man exposed to excessive fatigue, endemic miasmata, or any debilitating cause; the imbecility induced, occasions the same blood to promote the convulsive throb of fever. The discreet application of cold affusion shall in a short time restore lost energy, equipoise takes place, and convalescence of the system is assumed. Do these circumstances denote morbid strength—or morbid action from induced debility? Phlebotomy is only another means of attempting the same end. Contraction is the physical action of muscle, while relaxation is its forced state. When the transverse fracture of the patella occurs, the rectus contracts, but never is relaxed of its own accord. On this simple law would I be induced to explain the varied phenomena of the animal economy. Without any exertion on our part, the sphincter ani observes its physical contractility, till forced by air or feces to yield to superior power; and we can demonstrate the difference between physical and induced contraction, by the stimulus of the mind, or any foreign body affecting the anus, as by these applications it is thrown into a violent and convulsive state of contraction. In the levator palpebræ too, we discover the distinction between physical and induced contraction. When fatigue has over-

Synchronous Actions of the Veins, Cavities, and Arteries of the Heart.

I shall enumerate the sinuses and ventricles in the order in which they act; for two cavities only are full at one period, the other two being empty to receive and propel their contents. Since the sinuses and ventricles are synchronous, so must their appropriate veins and arteries. The sinuses are filled at the same period by their appropriate corporeal and pulmonary veins; the sinuses propel their contents, at the same time, into their adjacent ventricles; the ventricles being filled at the same time, propel their contents into their corporeal and pulmonary arteries at the same moment: these arteries, finally terminating in the corporeal and pulmonary veins, the blood is again returned to the sinuses, and thus the incessant circulation is sustained. This action is named synchronous. Thus the venous blood from the head, arms, and thorax, is conveyed to the heart by the cava superior, (Plate I. Fig. 2d and 5th, f,) and from the inferior extremities and abdominal or-

whelmed the powers of nature, the levator palpebræ, which has been continually in an induced state of contraction by mental influence, is overpowered by the superior contractile physical power of the sphincter oculi,—the eye continues shut till nature has been restored to energy by the suspension of mental influence during sleep. When organic energy is consummated, mental cognizance again occasions the contraction of the levator palpebræ, and the sphincter returns to a relaxed state.

May we hope that the reverential attention due to the phenomena of the animal economy may yet explain, on physical principles, those laws, wherein we read as anatomists, in legible characters,—the state and structure of muscles demonstrating that tone and veracity of action, on which health, pleasure, and perspicacity depend, by an adherence to God's laws; and that imbecility, delusion, and anguish, are inseparable from a deviation from these sacred principles, so far as corporeal agency is wisely instrumental, as cause of mental operation. We cannot be surprised at the influence of body on mind, so far as reflection depends on sensation, since this fabric is continually communicating informations depending on the state of its organs, which are taken notice of by the mind. Irritate gently with a pointed instrument the palm of your hand, this induces titillation; increase it, laceration of the same vessels and nerves takes place, and the pain attendant on it. The highest species of titillation or pleasure, verges on the confines of that convulsion denominated pain. Disease, pain, or delirium, seem only diversified species of those same wise and simple modifications of muscular economy, which promote health, pleasure, and a sound understanding; disease being an illegitimate convulsion, health a legitimate agitation of the same system, both of which are taken notice of by the soul. This is evident by attending to the mental incoherence flowing from any morbid affection of the organs of the body, as we see instanced in the momentary victim of delirium, furor-uterinus, priapism; or the Bac-

gans by the inferior cava, (Plate I. Fig. 5th, x). While, therefore, the venous blood of the body (now unfit for the purposes of life) is entering the right sinus (Plate I. Fig. 2d, g), the two right and two left pulmonary veins (Plate I. Fig. 5th, a) are effusing their contents (after being corrected in the lungs) into the left sinus (Plate I. Fig. 5th, b[1]). We observe the muscles of the right sinus large, distinct, and covered by a pellucid tendinous film; on the contrary, the muscles of the left (or posterior) are not at all discoverable, the membrane is so dense; the muscles of the auricle (l) are more perceptible. This seems to be the consequence of the contents during the progress of life, for in

chanalian in the paroxysm of intoxication, who, in a few hours, returns to the possession of reason, and to penitence;—proving to us the difference of the exciting causes, as well as the agents employed in these complicated phenomena; and our practice of depletion, or applications of stimuli, seem to illustrate the physical principles of the muscular economy, the healthy and morbid actions of which continually arrest the attention of the medical practitioner. The intellectual operations connected with these states of body, have universally alarmed the philosopher, and give rise to infidelity and folly, under the mask of philosophy.

[1] We often find five veins, three on the one side of the sinus, and two on the other. The term musculi pectenati (as anatomists denominate them) of the sinus, seems not applicable to the human subject. This name was given by the older anatomists, when brutes were principally the objects of dissection, and there the name applies to the structure; but in the human subject the sinus is composed of powerful swelling arborescent muscles, as Plate I. Fig. 3d exhibits. This figure supposes the sinus of Fig. 1st Plate I. opened, where the superior cava (a), unites with the inferior cava (k), and the membrana ovalis (or foramen ovale, f). By this section we discover a carneous segment (c) which was cut off from (a, f, k), the septum of the sinuses, sending off numerous branches, which intermingle with a similar carneous root (d), adjoining the ventricular orifice (Plate I. Fig. 1st and 2d, y); a very powerful root of muscular matter is seen (Plate I. Fig. 3d, a) proceeding from the orifice of the cava superior, which expands into numerous arborescent branches, uniting with those of the sinus. This tree is the auricular appendage of the right sinus inverted, to exhibit its structure, seen *in situ* (Plate I. Fig. 2d h). The Eustachian valve (Plate I. Fig. 3d, g), is a carneous semilunar body, bending along the anterior margin of the oval membrane, and terminating at the cava inferior (k); (h) is the orifice of the coronary veins, (Plate I. Fig. 4th and 5th, x): another vein is usually conspicuous anteriorly, (Fig. 1st, y): minute inspection may often detect veins likewise in the septum of the sinuses. (i) Is the orifice of the right ventricle, with the origin of the ventricular valves represented in action, (Fig. 2d, m).

the fœtus the muscles are nearly the same as those of the right sinus.

Structure and economy of the Sinuses.

The right [1] and left sinuses, being filled by the contents of their appropriate veins, they are excited to contract; but since the veins present open orifices, this blood would necessarily be thrown back, by this contraction, upon their cavities. This is, however, counteracted, by the powerful muscles diffused from the sinuses upon their veins, (as represented Plate I. Fig. 2d, f), which act as sphincters, when the regurgitation excites them. The fluid is therefore propelled forward from the right sinus (Plate I, Fig. 2d, h,) into the right ventricle [2] (k, ll); the valves (m), are thrown forward by the blood, (as represented Plate I. Fig. 2d, m), into the cavity of the ventricle; these are tied by (l) the chordæ tendineæ, to (k) the columnæ carneæ, which last spring from the parietes of the ventricle. These valves, from their number, are named valvulæ tricuspides, the two anterior being here seen. Numerous pillars (ll) are discovered, in the form of net-work, composing the internal structure of both ventricles; in the right, particularly, one very large tranverse column (sometimes two or three), knit the opposite walls together, which seem to occasion the heart to become thus the more readily excited by the stimulus of distention. This causes the impression to take place in well-injected hearts, as represented in the ventricle of Fig. 1st. The external surface of

[1] The right sinus, from its site, contents, and offices, may be named the right venous corporeal sinus, as it is situate on the right, and receives the venous blood from the body.

[2] From its site, contents, and offices, I would be disposed to denominate it the anterior venous pulmonary ventricle, as it is anterior respecting the other cavities, and it propels the venous blood of the body to the lungs. The anterior ventricle is commonly loose, and annexed apparently to the left, which is a dense powerful cavity, the parietes of which compose the septum cordis (Fig. 2d, l), and less capacious in its extent than the right. But I have now for many years demonstrated, that feeble subjects have frequently the left more extended than the anterior, nay, often double the dimension of capacity; and in warm climates this is so very often met with, that the left may really be denominated aneurismal in such cases. I shall, when we speak of the chest, mention several peculiarities of the heart.

[3] (Plate I. Fig. 2d and 5th, g,) is named the ascending aorta; (h, i, k,) the arch; (l, Fig. 5th) the descending aorta; of which (t) forms the intercostal branches. The distortions of the heart are such, as to render its parts very difficult to be described. The aortal orifice is situate between the posterior sinus (Plate I. Fig. 5th, b), and the pulmonary artery (Fig. 2d, n, o,

the heart is smooth; in feeble and aged subjects it is usually loaded with fat; the walls may be observed to possess longitudinal transverse and spiral fibres in their composition. From what we have said respecting the structure of the sinuses, auricles, and ventricles, their obliteration of cavity, when excited to contract, is obvious. The valvulæ mitrales (deriving their name from their shape) are two in number, one of which is seen (Plate I. Fig. 5th, f) placed between the left sinus[1] and the left ventricle[2]; their offices and actions are understood, from what has been said respecting the right sinus. The right ventricle having received the venous blood of the body in its route to the lungs, while the left receives the arterial blood from its sinus in its progress to the body, they contract at the same time. This contraction of the parietes upon their stimulating contents, would force back the blood to the sinuses, from whence it was propelled; but this retrograde motion carries back the valves toward the sinuses; the valves are retained in this firm situation, by their attachment to the columnæ, this forming a fixed basis on which the compressed blood is impinged, confirming the momentary septum composed of the valves; the arterial blood must necessarily be forced from the left ventricle (Plate I. Fig. 5th, d) into the current of the aorta (g), while the venous blood is propelled at the same moment from the right ventrical (Fig. 2d, l l), into the pulmonary artery (Fig. 2d, n o p).

Structure and economy of the Ventricles.

p); (r, s) being the anterior aortal valves *in situ*, as if viewed through a transparent medium. This will be better comprehended when I give a full description of the parts in relation to each other: (t, Fig. 2d and 6th), represent the serrated museles of arteries, which are insinuated into each other, and seem more conneeted with the elastie coat (Plate I. Fig. 6th, f), than with the internal membrane of the vessels. The serræ are not always so distinct in the aorta as in the extreme arteries, as the arm, &e. In feeble subjeets they are seareely seen in the limbs, though in a strong man they are as large in the extremities as here represented in the aorta. The failure of these seems the cause of aneurism, when the elastie coat has to present merely the passive principle of elasticity, unaided by aetive musele:—henee dilatation. Ossifieation seems a disease more or less connected with vessels in a state of debility.

[1] Or posterior arterial pulmonary sinus, denoting its site, eontents, and offices.

[2] Or left arterial corporeal ventricle, denoting its site, contents, and offices.

Structure and Economy of the Arteries and Veins of the Heart.

The aorta and pulmonary artery are each guarded by three semilunar valves; (r s, Fig. 2d, 6th, and 7th) represent those of the aorta or corporeal artery; (r) is the right, (s) the left, (t) the posterior valve; (Fig. 1st, 2d, and 7th, u) is the orifice of the right coronary artery, (v) the orifice of the left coronary artery, (seen r s, Fig. 1st and 2d), *in situ;* (n n, Fig. 2d) exhibit the two anterior valves of the pulmonary artery, which hide the posterior valve. These valves are formed by a semilunar reflection or duplicature of the internal membrane of the arteries, which Fig. 7th exhibits, the straight margin being loose, while the semilunation is fixed. This simple structure occasions the valves of the arteries to be applied to their cavity, when the blood rushes from the ventricle into the vessel, as represented (Fig. 7th, t); but when the arteries are excited to contract by the impetus of their contents, the retrograde blood carrying back the valves (as represented Fig. 7th, r, s), they meet, as seen (Fig. 6th), forming a triple cup, sustaining the column of blood in the aorta and pulmonic artery. The sinus or bulging of the arterial walls opposite to the valves (Plate I. Fig. 1st and 2d, n, n), is here distinctly and naturally expressed [1], from which those of the aorta, though in shade, may be understood [2].

The relative sites of the four cavities of the heart are, The corporeal sinus and ventricle are situate right and left—the pulmonary sinus and ventricle posterior and anterior [3].

[1] In the heart from which this is taken, the aorta does not seem anuerismal, but this vessel and the pulmonary artery are both very large.

[2] The orifices (v) of the coronary arteries are sometimes above, sometimes beneath the margin of the valves, as seen (Plate I. Fig. 7th, t u v).

[3] All these definitions are mere memoranda, by which the Student may with attention convince himself by the means of the heart of any animal. Fig. 6th, Plate I. exhibits a wire (a), suspending a ring surrounding the section of an aorta (b); (r s t) are the valves, represented half meeting each other; by plunging them in water they open; by raising them in the water they shut, and become three sustaining cups, from which the water cannot escape. The valves of the human heart meet more perfectly than those of the brute in the dead subject. By cutting off the apex of the ventricle and the posterior sinus, and affixing a wire around the apex, the same convincing demonstration takes place in the ventricles as in the arteries.

Induction. The scynchronous actions do not merely circulate the blood; this wise contrivance answers the following purposes likewise: they keep up the continual balance of the arterial blood which becomes venous in the body, and the venous blood which becomes arterial in the lungs. Thus, the anterior ventricle (Fig. 2d, l l) propels the venous blood by its artery (o p), to become corrected in the pulmonary veins (q), at the same moment that the left ventricle, (Plate I. Fig. 5th, d, Fig. 2d, v), propels its arterial blood by the aorta, (Fig. 2d, h i k) to the point of the finger (Plate I. Fig. 8th, a), where its arterial blood (a) becomes venous at (b) [1].

Recapitulation. The posterior sinus, Fig. 5th, a, is situate before the spine; the left ventricle (d), a triangular cavity, observes an oblique direction from it; its margin only (as well as the posterior auricle), is seen when viewed anteriorly, (Fig. 1st and 2d, v); its orifice bends to the right between the posterior sinus, (Plate I. Fig. 5th, b), and the anterior ventricle, (Fig. 2d, l); it sends off the curved aorta, which ascends to the opening of the thorax, and, observing an oblique direction, it reaches the spine. The right sinus has its auricle apparent anteriorly; its ventricle or triangular cavity sends off the pulmonic artery under the aortal arch to the right lung, and the left directly before the aorta to the left, (p). The trachea on the contrary, transmits its right branch directly to the lung, and its left passes under the arch of the aorta to reach its lung, Fig. 4th and

[1] The connections of the aorta, and the other appendages, are the following, viz. Plate I. Fig. 1st and 2d, the arch of the aorta is seen bending from behind the anterior ventricle, to become the arch, which sends off the right carotid and subclavian trunk (h), the left carotid i, and subclavian (k); it bends toward the spine, receiving under its arch the right branch of the pulmonary artery, which goes to the right lung, (viewed as if transparent, Fig. 2d, o); on the contrary, the left pulmonary artery (p), passes directly to its lung. The left branch of the trachea (a) Fig. 1st and 2d, is transmitted under the arch, to reach its left lung; this is seen, (Plate I. Fig. 4th, p). The aorta covered this body, and is cut off to exhibit the trachea and posterior sinus, the dotted line (n), pointing out the course the aorta held. In Fig. 5th, we find the outline of the vena azygos (m), entering (f), the cava superior under which the right pulmonary arteries, veins, and trachea, pass to their lung. Fig. 4th, (o), is the œsophagus, situated behind the trachea, between the cava and aorta (n). The thoracic duct is discovered entering the subclavian angle posteriorly (Plate I. Fig. 2d, d e).

5th. The zyphoid cartilage (z), shows, that part of the right ventricle and the whole sinus is contained in the right thoracic cavity.

GENERAL NOTION OF THE HEAD AND BRAIN.

THE complete Head may be arranged into the Cranium, which contains the Brain, and the Face, which is annexed to the Cranium, and becomes the seat of several organs of sense. These bones vary in their shape in different regions of the world, and in different individuals in the same region. In Europe, the cranium generally assumes more or less an oviform shape[1]. This organ is composed of eight bones. Plate III. Fig. 1st is the external; Fig. 2d the internal parietes of this cavity. They may be arranged into four single bones and two pairs. The four single bones are, 1st, the os sphenoides (Plate III. Fig. 1st a, Fig. 2d r c p *,—Plate XIII. Fig. 2d, x p o b c c w, Fig. 3d, a i w x p,—Plate XIV. Fig. 2d, x v w y). To this all the cranial bones, the ossa maxillaria superiora, vomer, and malæ are attached.—2dly, The os ethmoides (Plate III. Fig. 1st, b,—Fig. 2d, *e*) :—3dly, The os frontis, (Plate III. Fig. 1st and 2d, c) :—4thly, The os occipitis, (Fig. 1st and 2d, h). These four single bones are situate in the longitudinal direction of the cranium. The two pair are,—1st, The ossa parietalia, (Plate III. Fig. 1st and 2d, d e f) :—2dly, The ossa temporum, (Plate III. Fig. 1st, 18, 19, 20, 21,—Fig. 2d, d e u v y x t r,—Plate XIII. Fig. 3d, u r y l m). These two pair are arranged in the transverse direction of the cranium. From the three anterior cranial bones, viz. the ossa frontis, ethmoides, and sphenoides, depend the 13 bones composing the upper organs of the face, viz,

The Cranium.

The Face.

[1] By an attention to different countries, and the influence of local causes of climate, civilization, government, laws, morals, and religion, we observe the various organs of men liable, not only to varieties of shape, but likewise maladies peculiar to each organ, deducible from these simple principles. When, therefore, anatomical structure, and those leading causes which influence living matter, are more minutely investigated, it is probable that the solitary and delusive reasons, hitherto too frequently assigned for the variety in human figure, genius, and maladies, shall cease to operate, and their true causes respecting disease being recognized, their effects may be palliated or cradicated with the more certainty.

six pair and a single bone. But as the lower moveable jaw, (Fig. 1st, 14, 18, 10, m,) completes the face, we may enumerate fourteen bones, i.e. six pair and two single bones. Only nine bones appear in the external aspect of the face, which I shall first mention. These are, 1st, The ossa maxillaria superiora [1], (Plate III. Fig. 1st, *g h i k*, Fig. 2d, *c a g h i l*,—Plate XIII. Fig. 3d, *a k l*). To these bones all those of the face are attached, viz. 2dly, The ossa nasi, (Plate III. Fig. 1st and 2d, *b*): 3dly, The ossa unguis, (*c*): 4thly, The ossa malarum, (*d*): and, 5thly, The lower jaw, its parts being marked, (14, 13, 10, m). These compose the nine bones appearing externally in the face; the five bones, or two pairs and a single bone, observed internally, are,—1st, The ossa turbinata inferiora, (Fig. 2d, *f* [2]):—2dly, The ossa palati (*g k*):—3dly, The vomer (*h g*), represented in dotted lines.

Preliminary Notion.

A general notion of the connections and complicated offices of the bones of the cranium and face seems of the utmost consequence, in cases of wounds, caries, ulcers, &c. I shall endeavour to arrange these in as few words as possible [3].

CONNECTION AND OFFICES OF THE EIGHT BONES OF THE CRANIUM.

1st, The Os Sphenoides.

THIS irregular bone is composed of its body, its foramina on each side of the body, and its processes, which are sent off from the body. It is connected with all the bones of the cranium, of which it composes the transverse basis, (Plate XIII. Fig. 3d, a i w x p). It is connected with the brain, orbits, nostrils, and tem-

[1] (g) The nasal process, (h) atrium, (i) malar process, (16) foramen infra orbitrium, (k) alveolar process, which is completed posteriorly by the tuber.

[2] The name ossa infundibula seems more applicable, as they present a large opening anteriorly, which converges posteriorly in shape of a funnel.

[3] Thus the os frontis not only defends and sustains the brain, but forms the ceiling of the orbit, and part of the temples. While the os frontis, ossa parietalia, and cerebral region of the os occipitis, merely defend, and contain the brain; the os ethmoides, sphenoides, ossa temporum, and os occipitis inferiorly, become the exits of the nerves.

ples; viz. externally its temporal fossa joins the temporal fossa of the os frontis (Plate III. Fig. 1st, p), the anterior angle of the os parietale (d), the anterior segment (19) of the pars squamosa and of the pars petrosa (Plate XIII. r), os occipitis (p); the vomer is received on its inferior azygos process (*h*); the pterygoid processes (Plate XIII. Fig. 3d, i) compose the posterior nares; the hook (h) of the internal plate, on each side of the vomer (*gh*), is seen distinctly; anteriorly its small wing (Plate II. Fig. 3d, n) joins the orbitar process (o) of the os frontis; the great wings (m) join this process and the os malæ (*d*); the anterior azygos process receives on its surface the posterior portions of the os ethmoides (b). The small wings (Plate XIV. x) receive the posterior portions of the anterior cerebral lobes (Plate XV. x); the great wings (Plate XIV. k) receive the anterior portions of the middle cerebral lobes (Plate XV. z). The foramina will be mentioned in enumerating the nerves.

2dly, The Os Ethmoides.

This bone (Plate II. Fig. 3d, b, on the left side—Plate III. Fig. 1st, b,) is composed of its oblong square cribriform plate, its cubical body, crista galli, septum, and ossa turbinata; it is connected with the brain, orbits, and nostrils. Its crista galli (Plate III. Fig. 2d, *d*) and its cribriform plate, seen passing backward from it, is received between the orbitar processes of the os frontis (Plate XIV. l x). The crista sends off the septum narium (§). This body traverses the whole length of the cribriform plate (Plate XIV. 1, Plate XIII. Fig. 2d, h), and joins the anterior azygos process of the os sphenoides (Plate III. Fig. 2d, *), reaches the ossa nasi (*b*), and descends between the ossa turbinata (*e*). The ossa plana, (Plate II. Fig. 3d, b), form the parallel inner walls of the osseous orbit; the cribriform plate (Plate XIV. 1.) receives the bulbous root of the olfactory nerves, (Plate XV. 1.)

3dly, The Os Frontis.

This bone forms the sincipital region of the skull, (Plate III. Fig. 1st and 2d, ℓ). It is composed of a large smooth superior portion, (ℓ), convex externally; it is concave internally, and is impressed by the convolutions of the brain and the arteries of its

internal membrane[1]. A ridge or spine is usually found in the middle, which receives the frontal region of the falx, (Plate XIII. k). This portion of the os frontis defends the frontal region of the hemisphere, (Plate VI. n). From the lower segment of the large superior portion (or supercilium) is sent off the orbitar vault or processes at nearly right angles (Plate II. Fig. 1st and 3d, o,—Plate III. Fig. 1st, o,—Fig. 2d, o); these receive the anterior portions of the anterior cerebral lobes (Plate XV. x).

4thly, The Ossa Parietalia.

These bones compose the vertex, and laterally the temples (Plate III. Fig. 1st and 3d, d, e, f,—Plate XIII. Fig. 3d, d, e, f). Internally they compose a concave square, which defends the parietal region of the hemispheres (Plate VI. f, h). They are particularized by the superior margins where they unite, and receive in their mutual hollows (Plate III. Fig. 2d, f,—Plate IV. and V. e g.), where foramina are often present in the parietal region of the sanguineous sinus (Plate VI. e, n). Their anterior margins join the os frontis; their inferior segment the os temporis; their posterior the occipitis; their anterior inferior angle (d) transmits the trunk of the great meningeal artery (Plate III, Fig. 1st, 2d, d—Plate VI. k l m); the posterior angle (e) forms the receptacle of the lateral sanguineous sinus (Plate III. Fig. 2d, t,—Plate XIII. Fig. 2d, f,—Plate XIV.

[1] (m) Is the frontal sinus which communicates with the nostril. This and the other bones are marked internally by the convolutions of the contained brain, and the vessels of the dura mater. It may appear mysterious how hard bone becomes impressed by soft substances, as the brain and pulsating arteries; but this seems to arise from the vessels of the brain carrying on that viscus in an uninterrupted manner; the vessels of the dura mater likewise continually carry on their regular functions. The vasa propria of the bones are incessantly depositing their osseous materials in a perfectly fluid state, which occasions the bones to take on the mould of their contained organs. These observations apply to all the cranial bones. In the growth of the adult brain (for the young brain seems more regular) inequalities occur, which occasion some portions of bone to be as thin as paper, while the circumference is very thick (as seen Plate VI. h), while the bone observes its external convexity, and internally follows the irregular contents. This occasions a circumstance very teazing in the moment of trepanning. These seem more frequently near the longitudinal sinus than in other parts, and would appear to take place from inequalities in the brain after puberty.

Fig. 1st, t). Externally the ossa parietalia are smooth on their superior surface; they rise into a bump in the middle, where a white segment receives the temporal muscle, beneath which it is radiated, in consequence of the direction of the fibres of its temporal muscle, which is inserted into the superior region of the lower jaw (Plate III. Fig. 1st. 14).

5thly, The Ossa Temporum.

These bones form the lower region of the temples (Plate III. Fig. 1st, 18, 19, 20, 21,) and the lateral oblique basilary portions of the cranium (Plate XIII. Fig. 3d, r.—Plate III. Fig. 1, 18, 19, 20, 21,—Fig. 2d, d, r, v, u, x, y). These bones may be said to be composed of five principal parts, viz. the pars squamosa (Plate III. Fig. 1st, 19, 20, 21, 22); 2dly, its zygoma (18); 3dly, the pars petrosa (Plate III. Fig. 2d, v, x u, Plate XIII. Fig. 3d, r); 4thly, its mastoid process (Fig. 1st, 8); and, 5th, its styloid process (Plate III. Fig. 1st, s). We have seen its connections with the frontal and parietal bones; its mastoid process joins the lower termination of the os occipitis; its os petrosum is seen (Plate XIII. Fig. 3d. r,) situate between the sphenoidal and occipital bones. The foramina will be mentioned afterwards: (l) is the meatus auditorius externus; (m) the zygoma; (tt) the recipient of the lower jaw; the tentorium and superior petrous sinus (Plate XIII. Fig. 2d, g) is received on the ridge (Plate III. Fig. 2d, v);[1] the segment (Plate III. Fig. 2d, u) lodges the termination of the lateral sinus (Plate XIV. Fig. 1st, u); the pars squamosa (Plate III. Fig. 2d, r d) and superior surface of the pars petrosa (v), sustain the posterior portion of the middle cerebral lobes (Plate XV. s, u); the inferior portions of the pars petrosa sustain the lateral portions of the pons varolii (Plate XV. n, o); and the posterior angle (u) sustains part of the cerebellic lobe (Plate XV. §).

6thly, The Os Occipitis.

(Plate III. Fig. 1st and 2d, h) is somewhat oval, internally concave, convex externally. This bone forms the occiput (Plate III. Fig. 1st h), and basis of the cranium (Plate XIII. Fig. 3d, h p). It

[1] The tentorium in its base arises from the lateral fossæ of the os occipitis (Plate III. Fig. 2d s), the sinus of the posterior angle of the os parietale (t), and is continued along the ridge (v)

is connected with the os sphenoides by its cuneiform process (Plate XIII. Fig. 3d, p); to the pars petrosa (r), and by the mastoid process to the ossa parietalia (Plate III. Fig. 1st and 2d, h). Internally (Plate III. Fig. 2d, s) it is divided transversely by the fossæ (s), which contains the lateral sinus (Plate XIV. s); and vertically by the superior fossa (Fig. 2d, k), which receives the termination of the occipital region of the longitudinal sinus (Plate VI. e) and the inferior spine or sinus (l), which lodges the occipital sinus (Plate XIV. Fig. 1st, g, i). The superior fossæ (h) receive the posterior or occipital regions of the hemispheres of the brain (Plate VI. e) and the inferior fossæ (l) sustain the lobes of the cerebellum (Plate XV. §) [1].

The Dura Mater [2] Is a membrane easily separated into its external and internal laminæ (Plate VI. a, d, e, f), the former of which forms the internal periosteum of the bones, and toward which the vessels (Plate VI. i k l m) bend their course. This surface assumes a villous aspect, in consequence of the numerous vessels passing from the membrane into the inner tables of the calvaria (Plate V. c). In young subjects the adhesion formed by these vessels is so great, as to render the elevation of the bones very difficult; the bleeding points on the bones demonstrate the vascular orifices. In aged subjects, where the arteries are feeble, the bones are raised with ease. From this periosteum are sent off the three following septa [3] or duplicatures of the dura mater, viz.

1st, The Falx. (Plates VIII. h, and XIII. Fig. 2d, a). It commences at the crista galli (Plate III. Fig. 2d, *d*): its convexity traverses the frontal, parietal, and superior occipital regions (Plate III. Fig, 2d, e f k—Plate VI. n e f—Plate XIII. k l m) [4].

of the pars petrosa to the posterior clinoid process of the os sphenoides (r), of this figure, as delineated Plate XIII. Fig. 2d, s, f, g, r.

[1] These bones are lined internally by a dense membrane, named by the ancients dura mater.

[2] Dura meninx, meninges.

[3] Septæ duræ matris; these are strengthened by tendinous appendages stretched over them.

[4] Septum superior—falx duræ matris. This vertical septum is divided into its superior convexity (Plate XIII. Fig. 2d, k l m,) and its inferior concavity (a). It is insinuated between

2dly, The Tentorium. (Plate XIII. Fig. 2d b).[1] This conical septum is reflected from the inferior termination of the falx, and the lower parietes of the cranial bones beneath the tentorium. Its base occupies the fossæ of the os occipitis, and the triangular fossa of the os parietale (Plate XIV. s t), from which it is continued along the petrous fossa (v) of the os petrosum, to the posterior clinoid process of the os sphenoides (h). This septum sustains the posterior lobe of the cerebrum, (Plate XV. †), and covers the cone of the cerebellum, (Plate XII. g), from which the tentorium (y) is removed. The foramen ovale duræ matris (Plate XIII. Fig. 2d, c) admits of the connection of the cerebellum, by its crura, with the cerebrum.

3dly, The Occipital Falx, (Plate XIV. Fig. 1st, g), occupies the lower region of the os occipitis, (Plate III. Fig. 2d, l). It divides the lobes of the cerebellum, and becomes the conduit of the occipital sinus to be mentioned; this is sometimes bifurcated. It terminates in the foramen magnum occipitale, (Plate XIII. Fig. 3d, b), the foramen jugulare, or the vertebral veins, Plate XIII. Fig. 3d, v [2].

Recapitulation. The external surfaces of the Brain correspond to the eight bones enumerated, and the septa of the dura mater, viz.—the convexities of the hemispheres (Plate VII. and IX), correspond to the concavities of the os frontis, ossa parietalia, and the cerebral region of the os occipitis; the vertical regions of the hemispheres correspond to the falx; the anterior, middle, and posterior lobes, correspond to the os frontis, sphenoides, superior region of the ossa temporum, the posterior lobe resting on the tentorium. The cone of the cerebellum is covered by the tentorium, and its lobes are sustained by the lower region of the os occipitis. The pons varolii rests on the cuneiform processes of the os sphenoides and occipitis, and the inferior portions of the pars petrosa. The fora-

the vertical regions of the cerebral hemispheres, as delineated (Plate VIII. h), where the left hemisphere (a s b) is dissected off. The falx still hides the superior portion of the right vertical region of the right hemisphere; the lower part (*e d*) being uncovered by the falx. By lifting the falx, the vertical region of the right hemisphere appears.

[1] Septum medium, tentorium cerebello super extensum, septum occipitale majus.

[2] Septum inferior, septum cerebelli, septum occipitale minus.

men magnum occipitale transmits the spinal marrow. The cranium therefore contains the brain, admits the arteries of the brain from the heart, transmits the venous blood from the brain to the heart, and the nerves to the system of the body.

SANGUINEOUS SINUSES OF THE DURA MATER.

THE Dura Mater becomes the conductor of the blood from the brain, by three single channels, and four pair, which are embedded in the canals of the bones, and two single sinuses are formed entirely in the membrane.

The sinuses connected with the bones are,

1st, The Superior Longitudinal Sinus. (Plate VI. n e c,—Plate XIII. k l m). It has the os frontis, the ossa parietalia, and the superior fossa of the os occipitis, as the basis of its triangular cavity, the apex terminating in the falx, as seen (Plate XIII. k l m s). The veins of the brain (Plate VII. d,—Plate IX. d,) are inserted into this cavity, passing obliquely forward nearly an inch in its duplicature, as represented (Plate XIII. d); the anterior veins seem to enter at nearly right angles.

2d, The Transverse or Lateral Sinuses (Plate III. Fig. 2d, s t—Plate XIV. Fig. 1st, s t u), receive the longitudinal sinus by their apex, and are occupied by the occipital, parietal, and temporal fossæ of (Plate III. Fig. 2d s t u.)

3dly, The Superior Petrous Sinuses. (Plate III. Fig. 2d, v—Plate XIII. Fig. 2d g—Plate XIV. Fig. 1st h—Fig. 2d s)—This communicates with the transverse sinus at the parietal angle (t), and opens anteriorly into the sphenoidal sinus (Plate XIII. Fig. 2d c, r) to be enumerated [1].

[1] Here the lateral sinus leaves the superior petrous, and is concealed from view, when the tentorium is *in situ*; it is continued in the segment (Plate III. Fig. 2d, u) of the pars petrosa, and mingles its contents with that of the inferior petrous to be mentioned, where they unite in the foramen lacerum in basi cranii, (Plate III. Fig. 2d, y.) This foramen is so small in some subjects, as seemingly to account for apoplexy, on principles distinct from those taken notice of by authors in general. Short neck likewise is a conformation liable to apoplexy. This cannot become a cause of apoplexy from the simple principle of its shortness alone, as

4thly, The Inferior Petrous Sinuses, (Plate III. Fig. 2d, w,—Plate XIV. Fig. 2d r), are embedded in the fossæ of the pars petrosa and occipitis, and communicate with the foramen lacerum in basi cranii behind (Plate XIII Fig. 3d y) and the sphenoidal sinus before.

5thly, The Cavernous Sinuses. These sinuses (Plate XIII. Fig. 1st. r, c, u), are contained in the lateral fossæ of the sella turcica, of the os sphenoides, and the foramen lacerum of that bone, formed by the separation of the great and small wings of Ingrasius (Plate XIII. and XIV. Fig. 2d, u) :[r]

this equally facilitates the exit of the blood from the neck to the heart, as from the heart to the brain. We notice that athletic subjects are usually short-necked, of an eager disposition in the early periods of life. The ardour of their actions seems to occasion premature imbecility in the muscles of the heart and arteries; hence a disposition to venous congestion and a deposition of fat in the neck, as well as torpor in the veins of the brain. Some ingenious authors have denied the principle on which I have supposed this deposition to take place; viz. a defect in the perspiring power from debility in the arteries. Chemistry seems very ill adapted for establishing such delicate facts. The reader will forgive my directing his attention to Plate III. Fig. 4th, where a diagram of the integuments of the foot is given; (a) is the heel, (b) the hollow of the foot, (c) the anterior extremities of the metatarsal bones, (d) the last digital phalanges of the toes, (e) the metatarsal region of the foot. While very little fat is deposited in the hollow (b), where perspiration goes on freely, and where vesication never takes place, even in cases of the most violent walking—on the contrary, great deposition of fat is observed in all the other parts (a, c, d, e), where perspiration is prevented, from the impervious laminæ of the cuticula. Why the serum in the heel and other parts is taken up by the lymphatics, and the oil retained, is a topic which it is not my intention at present to agitate. I leave the fact to be considered by the liberal; and by them likewise I leave it to be decided, how far the practice of recommending exertion, tonics, &c. in cases of obesity, corroborates my suppositions of the causes of fat in the neck of apoplectic subjects,—fat being deposited by whatever means perspiration is defective, in such subjects as generate fat, for some do not in excess. This diagram was taken from a preparation in my museum, where the parent vessel (f) sent off the perspiring rami (h), and the arteries (g), which secrete the fat; these anastomose with each other freely as at (i). Where perspiration is checked at (h), the vessels send back their contents to the adipose rami (g), or vice versa. Partial vesication seems a local anasarca. Long-necked subjects are likewise liable to apoplexy. Still debility in them and old age becomes seemingly the proximate cause of apoplexy; and sudden passion, inducing languor, intoxication, or any stimulus inducing debility, predisposes to apoplexy. Even in languid paroxysm of fever, apoplexy is often indicated; and the conscientious physician, when watching the phenomena of the brain in fever, and other cases connected with debility, must occasionally be at a loss when sleep commences, to know whether it is the prelude to convalescence or morbid congestion.

[r] In languid states of the system, not only in the female subject afflicted with ame-

these communicate with the anterior orifices of the superior and inferior petrous sinuses.

6thly, The Circular Sinus, (Plate XIV. Fig. 1st and 2d, k), surrounds the body of the sella turcica or pituitary gland (Plate XIV. i), and communicates with the cavernous sinuses.

7thly, The Occipital Sinus (Plate XIV. Fig. 1st, g), occupies the inferior occipital region or spine of the os occipitis, (Plate III. Fig. 1st, g), and is sometimes bifurcated.

8thly, The Inferior Longitudinal Sinus (Plate XIII. Fig. 2d §,—Plate VII. i) is formed in the inferior concavity of the falx, and communicates with the next to be mentioned; it receives the blood of the adjacent hemispheres, and corpus callosum (Plate VIII. f g), by the veins (i).

9thly, The Torcular Herophili (Plate XI. c,—Plate XII. c,—Plate XIII. Fig. 2d, e s) is formed by a duplicature of the falx, (Plate XIII, a), and the tentorium (b). This sinus composes the apex of this conical septum, receiving the inferior longitudinal sinus, (Plate XIII. §), and the vena magna galeni (i). These convey the blood of the ventricles anteriorly; the torcular unites posteriorly with the longitudinal sinus (k l m), at (s), and the lateral sinuses at (f), communicating beneath with the occipital sinus (Plate XIV. g).

Recapitulation. Three single sinuses are received in osseous channels, viz. the superior longitudinal, the circular, and occipital. Four pairs are likewise received into osseous canals, viz. the lateral, superior, and inferior petrous and cavernous sinuses. Two are formed entirely in the membrane, viz. the inferior longitudinal, and the torcular. In all, there are 13 regular sinuses. Others occur, as the communicating sinuses in the great wings of Ingrasius, stretch-

norrhœa, but in the sanguine and feeble male likewise, the veins of the face and eyes which enter this process, meet so much resistance, as to occasion the discoloration around the lower eye-lid. In old age these veins become so varicose as seemingly to promise great relief by venesection. When a clear and exaggerated view of the sinuses and veins of the brain is required for demonstration, old subjects ought to be selected. In the fœtus, however, the anastomoses of the arteries and veins seem more easily accomplished by the art of injection occasionally, than in any after period.

ing between the cavernous and superior petrous sinus; and the anterior occipital sinus, which pass from the cavernous to the inferior petrous; but these are not always demonstrable.

SUTURES OF THE CRANIAL BONES.

THE connections of the bones are named Sutures. Their number and exact situation ought to be remembered, as fractures often assume similar appearances. Those most liable to external violence, and becoming the object of attention with the operator, are three in number; viz.

1st, The Coronal Suture, (Plate III. Fig. 1st, c—Plate IV. d), which unites the frontal and parietal bones.

2dly, The Sagittal Suture, (Plate IV. g), which unites the parietal bones with each other.

3dly, The Lambdoidal Suture, (Plate III. Fig. 1st, h—Plate IV. f), or the junction of the occipital bone with the parietal and mastoid process (8) of the temporal bone [1].

There are three lateral sutures, viz.

1st, The Sphenoidal Temporal Suture (Plate III. Fig. 1st, a), or the junction of the temporal process of the os sphenoides, with the os frontis and temporis.

2dly, The Temporal Suture, (Plate III. Fig. 1st, d e), or the squamose, the junction of the os parietale with the os temporis.

3dly, The Additamentum Suturæ Squamosæ (Plate III. Fig. 1st, e,—Plate XIII. Fig. 3d, e), or the junction of the posterior angle of the os parietale (in which is contained part of the lateral sinus) with the mastoid process superiorly.

Preliminary notion. In cases of wounds of the brain, it is of the utmost importance to determine, by familiar external marks, what parts are injured.

[1] The os frontis is always composed of two equal portions in the fœtus, formed of the half of the forehead, to each of which is annexed the orbitar vault. This sometimes continues through life, especially in feeble subjects, composing what is named the frontal suture, and is continued from the sagittal to the ossa nasi. The student ought likewise to recollect, that, in the early periods of ossification, the vasa propria of the bones often deposit partial defined rudiments of osseous matter, not only in the course of the lambdoid suture, as repre-

To accomplish this with precision, we not only require a knowledge of the bones of the cranium, but those of the face connected with them, so nearly do they approach each other. The suicide, by directing the fatal pistol toward the roof of the mouth, is likely to penetrate the pons varolii and cerebellum. We shall find that a ball, passing horizontally through the nostril, wounds the same bodies more directly [1]. It would seem that the mortality of such injuries depends on the connection of those parts with the root of the nerves. I shall arrange the fourteen bones which hang from the cranium, into their facial, orbital, nasal, and oral regions, or offices.

DESCRIPTION OF THE ORBITS, NOSTRILS, MOUTH, AND FACE.

General notion of the Orbit.

The orbit, or socket of the eye, is composed of seven bones, (Plate II. Fig. 1st and 3d) two of which form the internal parallel walls of the orbits [2]; the others are arranged into a hollow cone, the foramen opticum (Plate II. Fig. 3d n) of the little wings of Ingrasius being the posterior apex [3].

1st, The Ossa Unguis,

(Plate II. Fig. 3d, Plate III. Fig. 2d *c*), compose the inner canthus and anterior region of the parallel walls of the orbits.

2dly, The Ossa Plana,

Or the orbitar plate of the os ethmoides, is arranged behind the os unguis. These two form the parallel walls of the orbits; the other following bones assume a diverging aspect, viz.

sented in Plate II. Fig. 4th, but in all those regions where extensive membranes are present in the fœtus. These are named ossa triquetra, from their shape, or wormiana. They are distinguished from their connection with sutures, and have their own proper sutures, and ought to be recollected in the moment of operation, as they assume the appearance of fracture.

[1] See Plate II. Fig. 3d and 4th, u.

[2] The inner walls of the orbit are parallel to each other, as they are formed by the ossa plana and unguis, which last are in a manner the continuation of the os planum.

[3] The reader will attend to Plate II. Fig. 3d, (which is the outline of Fig. 1st) and Plate III. Fig. 1st, where the same references are observed.

3dly, The Os Frontis, (Plate II. Fig. 3d, o,—Plate III. Fig. 1st, o), which composes the arched ceiling of the orbit, the superior segment of the hollow cone, or orbitar vault.

4thly, The small and great wings of Ingrassius. (Plate II. Fig. 3d,) These form the external divaricating root of the hollow cone of the orbit; the small wing (n) finishes the posterior termination of the ceiling, joins the os frontis posteriorly, and is perforated by the foramen opticum (n). The oblique opening between the small wing and orbitar process (m), is the foramen lacerum orbitarium superius[1].

5thly, The Os Malæ, Plate II. Fig. 3d, composes the external canthus and external anterior region of the orbital cone.

6thly, The Os Maxillare. (Plate II. and III. *p*). Only this orbitar plate enters into the composition of the floor of the orbit.

7thly, The Ossa Palati. (Plate III. Fig. 2, g k). The orbitar, or superior, process of this bone is a small triangle, the lower part of which forms the foramen spheno-palatinum (Plate III. Fig. 2d, g). It is situate at the posterior angle of the maxillary plate.

By attending to the direction of the orbits, we discover that the eyes embrace a general horizontal hemisphere, without any exertion of these organs. At the same time, only one single object can be distinctly discerned by the eye in one fixed position.

General notion of the Nostrils. This complicated organ is composed of three single bones, and of five pair, of which the ossa maxillaria superiora form the basis and largest share. The five pair are,

1st, The Ossa Maxillaria Superiora. (Plate III. Fig. 1st and 2d, *a*,) The letter *a*, (Plate III. Fig. 2d), is placed at the antrum maxillare, which communicates with the nostril. They are connected with the following bones. (Plate III. Fig. 1st and 2d, *a*) compose the side-walls and floor of the nostrils, and sustain (in conjunction with the ossa palati) the ossa infundibula and the vomer, to be mentioned.

2dly, The Ossa Nasi, (Plate II. Fig. 3d,—Plate III. Fig. 1st and 2d, *b*), which depend from the os frontis, and form the arch of the nostrils.

[1] Or foramen lacerum of the os sphenoides. This varies very much in its size in different subjects.

3dly, The Ossa Unguis. (Plate II. Fig. 3d, *c*). This bone forms the ductus ad nasum anteriorly (Plate III. Fig. 1st, *c*); internally, it communicates with the frontal sinus (Fig. 2d, m), and the os spongiosum inferius (f)[1].

4thly, The Ossa Palati. (Plate III. Fig. 2d, g). This is received on the pterygoid process (i) of the os sphenoides, and forms the posterior region of the nostril.

5thly, The Ossa Spongiosa Inferiora. (Plate II. Fig. 3d, *f*,—Plate III. Fig. 2d, *f*), Or ossa turbinata or infundibula, which anteriorly form the inferior termination of the ductus ad nasum, being joined to the semi-hollow of the maxillary bone (Plate III. Fig. 2d, §), points out the extent of the duct. The (*a*) above this bone exhibits the site of the antrum maxillare, where it opens into the nostril.

The three single bones are,

1st, The Os Sphenoides. The pterygoid processes compose the posterior nares, (Plate III. Fig. 2d, i,—Plate XIII. Fig. 3d, *i*).

2dly, The Os Ethmoides, (Plate III. Fig. 2d. *e*), the ossa infundibula superiora (or spongiosa). Although the os ethmoides is a single bone respecting its crista septum, and its cribriform plate, it is a double bone, when we comtemplate its ossa turbinata and the inferior surface of the cribriform plate. This last forms the superior region of the nostril, and the ossa turbinata are suspended in middle of these cavities, hence admirably adapted to the reception of effluvia[2], (Plate II. Fig. 3d, *e*, Plate III. Fig. 2d, *e*.)

3dly, The Vomer, (Plate III. Fig. 2d, *h*,—Plate XIII. Fig. 3d, *h*) is attached to the sphenoidal azygos process above, the cartilaginous septum superiorly, the crista maxillaria (§) anteriorly, and the ossa maxillaria and palati inferiorly.

Recapitulation. The nostrils are composed of three single bones, the os ethmoides, vomer, and os sphenoides; and five pair, viz. the ossa nasi,

[1] The course of the duct is represented by the marks (§ §). This conveys a notion of the drain of the tears, which escape at (c Fig. 2d). The mucus of the nostril and the contents of the nasal duct are distinct fluids.

[2] Its septum has been described, and is sent down from the crista galli, traverses the cribriform plate, and hangs between the ossa turbinata, receiving the cartilaginous septum upon its margin.

unguis, spongiosa inferiora (or infundibula) palati, and maxillaria superiora; in all, the nostrils are composed of 13 bones; but as the os ethmoides and sphenoides have their processes in pairs, and that the ethmoides has a septum, we should arrange not only the singleness of these bones in our notions of the nostrils, but their multiform structure likewise.

The Face. This department of the head is composed of the ossa maxillaria superiora, nasi, malarum, and lower jaw.

The Mouth. The osteology of the mouth consists of the superior maxillary bones in their palate processes (Plate XIII. Fig. 3d, *l*); the palate processes of the ossa palati (Plate XIII. Fig. 3d, *k*) [1]; and the lower jaw (Plate III. Fig. 1st, 14, 18, m.)

MUSCLES, VESSELS, AND NERVES ON THE EXTERNAL PARIETES OF THE CRANIUM.

Preliminary notion. By external marks we may recognize, not only what parts of the brain are injured, but likewise such parts as are exterior to the brain. The following references lead to these objects. Plate III. Fig, 1st, c, points out by dots the extent and situation of the frontal muscle; (i) the site of the occipital muscle; the white ridge (c) of the os frontis and os parietale, compose the origin of the temporal muscle, the fibres of which converge toward (14) the coronoid process of the lower jaw, where it is inserted. Vessels and nerves are diffused beneath and on the surface of these muscles, viz. the rami of the internal maxillary artery (Plate III. Fig. 1st, 9), and

External Arteries of the Head. the temporal arteries (19, 20, 21,). They may be arranged as follows, viz. The common trunk of the carotis communis having ascended to nearly the angle of the lower jaw, sends off two

[1] There are commonly 14 teeth in each jaw, often 16, (Plate II. Fig. 3d,---Plate III. Fig. 1st); (1) is the central incisores, (2) the lateral incisores, (3) cuspidatus, (4, 5) bicuspides, (6) anterior molares, (7) middle molares, (8) posterior molares, or dens sapientiæ, often wanting. I frequently find the lateral incisores wanting.

branches, viz. the internal carotid (2), [1] from which the external carotid (3) has its origin. From this last the following arteries proceed; 4, The Thyroid; 5, Lingual; 6, Facial; 7, Occipital; 8, Posterior auris [2]. About the middle of the ascending ramus of the inferior maxilla, or sometimes a little higher, the internal maxillary artery has its root. All its branches lie within the zygoma, and are tinted variously to prevent confusion. They are supposed to be viewed through a transparent medium [3]. The external maxillary sends off, 1st, the artery of the lower jaw and teeth, (10, yellow), which enters the internal foramen (Plate III. Fig. 2d, m) and after supplying the teeth in its passage through the groove of the lower jaw, escapes by the foramen mentale (Plate III. Fig. 1st, m); 2dly, The posterior deep temporal (11, green) which lies between the bones and the muscle; 3dly, The trunk is continued along the root of the spinous process of the sphenoidal bone, giving off the middle meningeal artery (18, blue). This vessel, after entering the foramen spinale (Plate XIII. Fig. 1st—Plate XIV. Fig. 1st, x), is diffused into its anterior and posterior meningeal branches, as represented in Plate III. Fig. 2d, d r—Plate VI. and Plate XIV. k, l, m. The course of this artery within the scull as if viewed through a transparent medium, is represented by the blue dotted vessel, along the anterior and posterior parietes of the parietal bone, Plate III. Fig. 1st. The vessel ter-

[1] The blue vessel (1) behind, is the internal jugular vein. I find considerable varieties in the site of the bifurcation of the external and internal carotids, as well as the commencement of the ramifications sent off from the external: they are occasionally considerably below the angle of the jaw.

[2] The lingual and facial often come off from one root; in other cases they are so separated, that a wound by a ball might be inflicted between them with impunity. The posterior auris often comes off from the occipital.

[3] The internal maxillary branches are covered by the lower jaw, its muscles, and the os malæ. The reader is supposed to be viewing these vessels through the parts as if transparent. This relative idea is the object of importance to the practitioner. Paintings of the vessels, freed from their connected objects, lead to no practical use. The dissector therefore ought ever to have it in view, that every step in dissection should impress the mind, not merely with parts or organs singly, but their connections with other parts, as in the living body.

minates in a crooked direction (white, 13, 14) on the temporal fossa of the os sphenoides, supplying the muscles by its upper rami, and sending a trunk into the gutter of the orbitar plate of the os maxillare superius (Plate II. Fig. 3d, *p*), where it escapes by the foramen infra orbitarium of the os maxillare superius (Plate II. Fig. 3d and 4th, 2, Plate III. Fig. 1st. 16). Its lower ramus, being remarkably crooked, is diffused downward on the tuber maxillare, supplying the teeth of the upper jaw (Plate III. Fig. 1st, 15). (18) Is the site of the artery named transversalis faciei; (19) the middle temporal artery; (21) the anterior superficial temporal artery; and (22) the posterior superficial temporal artery.[1]

PLATE IV.

Commencement of the Dissected Plates.

In every step, the dissecting student ought to proceed as a practitioner. The mode adopted in removing the integuments should be similar to that we observe when called in to examine the brain in morbid cases, viz.—a section of the integuments is to be made across the middle of the head, from the one ear to the other, and the integuments carried forward to the eyebrow and backward to the occiput, which admits of the replacement of the brain and the calvaria after examination of the brain.

The management of the saw requires more dexterity than some may imagine. This operation consists in a laceration of the bones by the teeth of the instrument. The elegance and dexterity of this step depends on rather supporting the saw than pressing upon it, and passing it swiftly in a straight line over the bone, till a cut line is established. This is best executed by directing the saw along the thumb of the left hand, the nail of which ought to be placed above the teeth, thus serving as a fixed point to the instrument.

[1] The nerves are, 1st, the ophthalmic (Plate III. Fig. 4th, 1); 2dly, the infra-orbitary (2); 3dly, the mental (m); 4thly, the pes anserinus (7). The frontal artery is represented Plate IV. Fig. 1st, 17.

PLATE V.

The Calvaria.

THIS plate represents the calvaria in their internal appearance; the sutures are observed to be nearly linear internally; the inequalities mentioned (h), which correspond to the brain, are represented, which are very frequent in the ossa parietalia and os frontis. The arterial sulci are often very deep, as here shewn at (i).

PLATE VI.

The Dura Mater.

THIS membrane in its external lamina is here exhibited. The lacerations of the coronal suture (d), sagittal (e), and lambdoidal suture (f), point out the regions of those bones. The inequalities (h) are evident, as likewise in the frontis.

The dura mater assumes a bluish tint externally. Its surface is completely villous, arising from the congeries of vessels passing from this membrane into the substance of the inner tables and cancelli, as their vasa propria or nutritia. These anastomose with the frontal, temporal, and occipital arteries, Plate III. Fig. 1st. In young subjects, these vessels are so numerous and powerful, that the bones are raised by the operator with great difficulty; on the contrary, in old subjects, where the vessels are few, and comparatively feeble, the bones are elevated with ease. The longitudinal sinus (n n) is seen in great part of its extent which was connected with the spine or groove of the os frontis, (Plate III. Fig. 2d, e), the hollows of the ossa parietalia (f), and the superior sinus (k), of the os occipitis. The dura mater has no openings externally in this sinus, except at the superior (n, Plate IV. and V.), where the veins of the cranial integuments occasionally enter the sinus, and where the sinus may occasionally empty its contents into these veins.[1]

[1] Plate IV and V. (g) the venous orifices which communicate with the sinus are represented; they convey the blood from the integuments. These venous openings are not always present; if present, would a section of them, in apoplectic cases, become

Laminæ of the Dura Mater.

The dura mater is composed of two laminæ. The external lamina is the nidus of the arteries (or periosteum) of the internal system of the bones of the head. The arterial rami have their chief determination toward these bones. The most material branches are derived from the internal maxillary artery already mentioned; the root of which lies nearly an inch within the anterior portion of the hinge of the lower jaw, (Plate II. Fig. 1st, 18). This great or middle meningeal artery, having entered the spinal foramen of the os sphenoides, spreads into the anterior or superior artery, (Plate III. Fig, 2d, d), and lower or posterior artery (Plate III. Fig. 2d, r) and their rami, (Plate VI. and XIV. k l m). The superior or anterior branch and its rami (Plate III. Fig. 2d, d—Plate VI.—Plate XIV. k), after reaching the spinous process, or anterior inferior angle of the os parietale, (Plate III. Figs. 1st and 2d, d), often passes an inch in an osseous groove[1], and commonly is here inclined obliquely backward, after which it usually observes a direction more or less parallel to the coronal suture, as represented (Plate VI. k,) from which another (Plates III. VI. and XIV. l) is usually sent off. The anterior artery (i) is commonly from the external carotid, the trunk entering by the external opening of the foramen lacerum, (Plate III. Fig. 2d, i—Plate VI. i—Plate XIV. Fig. 1st, i). The posterior arteries of the dura mater, which enter by the orifices of the various venous foramina of the ossa parietalia, the foramen lacerum posterius, and other auxiliary openings, are very small. The veins of

serviceable? The local distress in this region is often tragically tormenting. In fever and apoplectic cases, patients are liable to distressed sensations when lying on the back. Does this arise from the blood in the veins of the brain receiving an increased resistance by meeting the column in the longitudinal sinus? May night-mare, &c. depend on this? In all critical cases of derivation toward the brain, the patient's head ought to be kept high, and great care paid to raise him to a sitting posture, when coughing takes place (which is often an attendant), as the patient frequently expires from the want of gravitation of the blood in the jugular vein.

[1] When this portion of bone is present, and is removed by operation, in such instances a fair section of the artery must be made, and will require two ligatures to check the hæmorrhage.

the dura mater are sometimes double, one placed on each side of the artery, though I meet with them single (s) and larger. They sometimes escape, partly by the spinal foramen, but more commonly communicate with the adjacent sinuses mentioned. The internal lamina of the dura mater thrown up (Plate VI. o), not only has a different office, but a different structure and aspect from the external; it is smooth and of a splendid silvery tint, becoming the investing membrane of the brain and nerves.

Tunica Arachnoidea.

Beneath the dura mater another investing membrane is discovered, named tunica arachnoidea[1] (Plate VI. p). It is transparent, and no vessels have hitherto been traced on its surface. This membrane, on the superior surface of the brain, is detected by means of inflation only; but it is commonly conspicuous between the pons varolii and the medulla spinalis, (Plate XV.) without any art being used; and here it assumes a loose appearance, and a more dense texture.

The Pia Mater.

The pia mater[2] is the membrane immediately in contact with every surface of the brain, (Plate IV. q), and seems destined to form the nidus of the arteries and veins of every part of that organ, as will be afterwards noticed, in speaking of the convolutions and ventricles. The pia mater being raised from the convolutions, it assumes the appearance of a villous web, transmitting its vascular branches into the substance of the brain, and has on this account received the name of tomentum cerebri.

PLATE VII.

The Hemispheres, Falx, and Corpus Callosum.

THE dura mater has been removed by the margin of the bones on the left, and is inverted on the right. This brings into view the convexity of the hemisphere (a), and its vertical region (*e*): the falx, (h), is seen covering the vertical region of the right lobe, except the lower portion of it, (*d e*). The dissector ought to re-

[1] Membrana arachnoidea. [2] Localis membrana—meninx tenuis.

mark the adhesions which are observed at the upper margin of the hemisphere, where the glandulæ pacchione, (c), bodies of a cineritious appearance, not understood in their office, approach the longitudinal sinus, (Plate VIII. h), which lie between the hemispheres when *in situ*. The whole of the cerebrum is composed of convolutions (b) externally as represented in this and the other plates; these possess distinct surfaces, penetrating more than half an inch in the substance of the brain. On these surfaces the pia mater is diffused, as the tomentum cerebri. This conformation seems to present the greatest given diffusion of vascularity, in the smallest given space. On the action of these vessels the phenomena of the sensorium commune perhaps depends.

The hemispheres assume the shape of half an egg, the small end anterior; and we form to ourselves a tolerable correct idea of their vertical regions, (which terminate in the corpus callosum), by supposing a longitudinal section of this egg shape, which will represent the vertical region, (Plate VII. IX. *c e*). These correspond to the falx, (Plate VIII. h), the falx being insinuated between the hemispheres. The falx of Plate VIII. however is evidently unconnected with the hemispheres at (*d e*), about a quarter of an inch above the corpus callosum[1]; hence the pia mater is apt to coalesce, and when the operator separates the hemispheres, to look down on the corpus callosum, (Plate VIII.), he is apt to mistake the laceration of the hemispheres for the corpus callosum; but he must continue till he discovers a purely defined white body. The veins of this (Plate VII. d), previous to separation, entered the longitudinal sinus of the Plate VIII. below, seen at (h). The hand is introduced in this plate to exhibit the left half of the corpus callosum, on which the left hemisphere rested, the other hemisphere *in situ* covering the right side of the corpus callosum; the little finger presses back the falx and right lobe, while the thumb displaces the left.

Where water is suspected in the ventricles (which shall be after-

[1] Commissura magna cerebri.

wards described), the operator ought to be cautious in the manner of separating the hemispheres, as the corpus callosum is apt to be lacerated; and where fissures take place in such cases, water is usually found in the cavities below; and when attention is not paid, the fluid is apt to be awkwardly spilt, and the quantity not duly ascertained.

PLATE VIII.

The Hemisphere removed, and Centrum Ovale exhibited.

THIS plate exhibits the removal of the left hemisphere in the step toward examination of the ventricle. The hemisphere may be removed in a horizontal direction, half an inch above the level of the corpus callosum, as the ceiling (r r g f) of the ventricle below is often elevated a considerable way by disease [1]. In this section we become acquainted with the two substances which always enter into the composition of every distinct body composing the brain, viz. the cineritious matter (a) which composes the external surface of the convolutions, and the centrum ovale (s s), or medullary matter (b), which is continued into the convolutions as their inner substance. The name cortical substance cannot apply in general to the cineritious, as this matter is found internally in some bodies. This substance varies much in different subjects and diseases; in young and vigorous bodies, it seems more florid than in the aged or feeble; in apoplexy it is often chocolate-coloured [2]. We shall find every body composed of these two substances in one direction or another. I cannot, in our present state of ignorance, ascribe the intention of either of these substances, as they are always present in every organ connected with the brain and nerves; and phenomena do not furnish us, seemingly, with data

[1] This frequently is the case from hydrocephalus internus during youth, which had been got the better of; in such cases an empty cavity is discovered.

[2] The hemisphere of the brain (Plate VI. r) from which the pia mater (q) is removed, conveys a notion of the healthy appearance of the cineritious substance.

of distinction respecting the operations of the one more than the other. I therefore at present wave tracing those parts, as well as the nerves, in their internal connections of the brain, till leisure and numerous dissections enable me to recognize these objects, and furnish plates of their connections, and compare these with the late opinions of ingenious anatomists, who have laboured so laudably in this important and hitherto mysterious topic.

At (t) we observe the tomentum and its vessels, continued on each adjacent convolution; and here an inner reflection of the convolution is represented as turning within the external. Vessels emerge from the pia mater, and ramify solitarily in the substance of the medulla of the brain ; and, in apoplexy, the veins corresponding to them are often in a state of rupture, when no injury is evinced in the large trunks of the veins, which are continued into the dura mater, to be more particularly described [1].

Some anatomists recommend dissecting off the surrounding cineritious convolutions of the brain in all directions, as represented by (s s), to exhibit the arched nucleus of medullary matter, named by Vieussens centrum ovale; but this seems less proper than the horizontal section, which displays the oval medulla continued into each convolution. The convolutions being removed, the whole cerebrum corresponds to this idea, exhibiting a uniform medullary nucleus connected with the centre of the brain. The attentive observer may often detect a middle medullary line, continued in the course of the cinerea throughout the whole convolutions. The cineritious border (r r) represents the lower margin of the hemisphere, half an inch above the level of the corpus callosum ; from this portion, the continuous or incumbent vertical wall of the hemisphere has been removed, which was reflected from this, and rested on the left half of the corpus

[1] Does this indicate the appropriate functions of the trunks and extremities of arteries, the former being mere carriers, the latter agents, on which ultimate phenomena of action depend? The elastic coat seems strongest in the trunks, and the muscular annuli most powerful in the extremities of the vessels ; hence aneurism occurs most commonly in trunks. We observe large vessels presenting open mouths, while small vessels contract.

callosum (f g), here exhibited. When this border is cut off, the corpus callosum is seen uniting by its transverse striæ with the medulla of the brain.

Corpus Callosum.

The corpus callosum, as well as other distinct portions of the brain, is very varied in its shape and dimension in different subjects. This represents the medium appearance and size. It is sometimes formed of a regular arch, and in other cases waved, broadest posteriorly, and hollowed where the falx is reflected toward its anterior and posterior attachments. Two medullary lines run on each side of (g) the raphe, from which the medullary striæ (f) are directed toward the medulla of the hemisphere. Previous to removal of the falx, or hemisphere, on the right, the connections of the falx ought to be examined in its various relations with the crista galli, the cranium, and brain.

The Superior and Inferior Longitudinal Sinus, Falx, &c. *in situ.*

The smooth internal surface of the dura mater (p) is thrown up as continuous with (k), the superior longitudinal sinus, into which the great veins of the brain enter, (Plate VIII. d, Plate IX. d). The anterior veins seem to be inserted at right angles, but those behind penetrate nearly an inch in the laminæ of the dura mater, observing a direction obliquely forward, as represented (Plate VIII. h, Plate XIII. Fig. 2d, d)[1]. The sinus is kept tense by tendinous bridles, (Plate VIII. o). The inferior longitudinal sinus (i), receives the blood from the adjacent parts, by numerous veins which enter its cavity, and transmits the blood to

[1] The veins of the brain have no valves in their cavities. This unsupported state of the column of the venous blood seems aggravated in the veins of the brain, by the anterior direction of their contents meeting resistance from the blood in the longitudinal sinus, which observes a retrograde course towards the lateral sinuses, (Plate XIII. Fig. 2d f). Numerous cases have come under my observation, where great quantities of blood had escaped into the substance of the hemispheres, as well as the ventricles, from rupture of the extremities of the veins, while their trunks continued unaffected. All the organs over which the mind has not immediate control (or vital organs), except the heart, are void of valves in their veins; on the contrary, every organ has valves where the mind operates. All the vital organs possess only one species of muscles, which contract on the application of their contents,—such are not liable to paralysis; but organs over which mind has control have opponent muscles, and are obnoxious to paralysis. The reasons for these contrivances are evident: the contents extend the muscles of the vital organs, as the heart, arte-

the torcular herophili, or middle sinus of the tentorium, (Plate XIII. Fig. 2d, e s). The falx is composed of a duplicature of the dura mater, as we have mentioned, having the superior sinus as the convex margin, which is a triangular cavity, having the bones mentioned Plate III. Fig. 2d, Plate XIII. Fig. 2d as the base of the cavity, and the falx as the apex. The lower concavity (i), or inferior sinus, is its lower boundary. The falx, as well as the rest of the dura mater, has tendinous portions stretched over its surface, which keep the parts tense. This septum, as well as the other parts of the dura mater, is very liable to have osseous matter deposited in its substance by its vasa propria, to which some have ascribed epilepsy; and I have seen masses upon the point of being disengaged from the membrane, which must have pricked the vertical walls of the cerebrum. All the portions of the dura mater are obnoxious to this occurrence. In the case of an idiot I shall mention, the falx was absorbed, and the vertical walls of the hemisphere completely grown together as one solid mass. In this subject the cerebrum was denuded by local disease, and the cerebral arteries partially attached to the dura mater by the process of inflammation. These rami were depositing osseous spiculæ in that membrane, while the other branches deposited the materials of the cerebrum, a seeming proof that vessels are actuated by the appropriate organs with which they are connected, clearly illustrated in this instance[1]. The vessels of the comb of

ries, veins, bowels, urinary bladder, &c.; but the members of the body require opponent muscles. The absence of valves in the vital organs must have wise intentions, though I wave at present my opinions on this topic: the absence of valves, however, predisposes them seemingly to disease, though sleep is a function intimately connected with whatever excites disease.

[1] Not only do we find vessels which are spread on the membranes of bone deposit this osseous matter, but the vessels of all membranes, which are not connected with muscles of volition, are liable to take on this process; such as the valves of the heart, the inner membranes of the aorta and its ramifications, the pleura, even the lungs, so very membranous, I have seen partly in a state of ossification, the peritonæum, &c. In subjects predisposed to anchylosis and exostosis, even the cellular membrane of muscles has been discovered connected with osseous deposition.

a cock, when brought into living contact with his talon, will deposit horny matter where this body is inserted [1].

The Ceiling of the Ventricles.

The ceilings of the lateral ventricles are composed of equal parts of the centrum ovale and the corpus callosum. The dots (Plate VIII. r r,) denote a distance in the centrum ovale, equal in breadth to the left half of the corpus callosum, and parallel with it. When the brain has been in health, the external margin of the ventricle, which is formed by the outer edge of the corpus striatum, (Plate IX. p), is nearly on a level with the corpus callosum, and sometimes even beneath this level [2]. The operator is to scratch with the edge of his scalpel, in the course of (r r) till he discover a bluish appearance, which is the pia mater of the ceiling; and to exhibit this, without rupturing it, is always interesting, but peculiarly so when water is in the cavity, the fluctuation of which will be communicated to the pia mater.

PLATE IX.

Ceiling of the Ventricles removed.

This plate exhibits the left ventricle. When the incision is made as directed, the corpus striatum (p), in its external margin, is brought into view. The ceiling being gently elevated by the flat edge of the scalpel, the external margin of this body will appear higher than the internal. It inclines obliquely downward where it approaches its fellow; this may be understood by Plate XII. By elevating the ceiling of the ventricle, the dissector may discover it composed of the lower surface of the centrum ovale, (Plate VIII. r r), the corpus callosum (f g), the septum lucidum, (Plate IX. k), and the fornix, (Plate XI. l, X. r). All these bodies are in a state of continuity.

[1] See Hunter.

[2] In disease the ventricle is frequently extended laterally beyond the boundary of the outer margin of the corpus striatum. It should be recollected, that the corpus striatum, in its external margin, is higher in the middle than anteriorly or posteriorly.

The fornix is discovered as the lower triangular septum of the ceiling; and, in a state of health, this department of the brain exhibits no character of ventricular appearances, but really composes a series of various bodies in contact with each other, the lower bodies sustaining the superior, and a limpid fluid lubricating their surfaces[1]. This plate delineates the appearances taking place when the operator has made a vertical section of the corpus callosum[2] (l), leaving the septum (k) entire. The parts I hope require little definition[3]. The septum (k) is continuous with the corpus callosum (i), and this last is continued into the substance of the fornix (l). Along the outer margin of the fornix, the plexus choroides (m)[4], has its course. The white portion (n) discovered on the external margin of the plexus, is part of the thalamus nervi optici; the rest of this body is covered by the fornix. The curvature (o) is the tænia striata[5]. The corpus striatum (p), is a body similar in shape to the quarter of a pear, curved in its internal margin, which is lower than the superior margin. Its external margin is likewise curved in its vertical di-

Corpus Callosum.
Septum Lucidum.
Fornix.
Plexus.
Thalamus.
Tænia.
Corpus Striatum.

[1] In disease they become cavities containing water, blood, &c. I have met with them likewise in the state of large cavities perfectly dry, and in other cases dry, but not dilated; the pia mater of the floor and ceiling occasionally in a state of accretion; and sometimes the speck appearing in the inner membrane of the aorta and arteries, previous to ossific deposition, may be observed. Cartilaginous bodies likewise are found generated in the ventricles. This may be named the superior region of the lateral ventricle.

[2] The vertical striated appearance of the corpus callosum is here represented.

[3] The student ought to aid his knowledge, and acquire the dexterous use of his instruments, by dissecting the brain of animals, which will assist in leading him to a recognizance of the human brain.

[4] The plexus is usually of a dark colour, approaching to black, and seems a congeries of arteries and veins; but, occasionally, this is seen of a perfect white appearance, the vessels empty, assuming the appearance of a congeries of empty thread-like bodies. Vesicles, analogous to hydatids, are very frequently met with here.

[5] Named likewise centrum semicirculare geminum—tænia semicircularis. These are not always medullary lines, but in disease are bluish, and of a gelatinous consistence. This circumstance seems to have been little noticed by anatomists, though I have regularly demonstrated the fact to my pupils since the year 1795. The ingenious Mr Charles Bell of London, to whose labours the world is so much indebted, seems to take notice of the same appearance. In vigorous and young subjects they often assume the appearance of two delicate white lines, as mentioned by authors.

rection, being higher in the middle than at the anterior and posterior portions; the greater bulbous end is anterior, and the small posterior extremity diverges.[1] Below the anterior margin (q) of the fornix, there is an aperture which communicates with the lateral ventricles, (Plate XII.) and the infundibulum (Plate XV. y). This was first described as present in the human species, by the justly celebrated anatomist Dr Monro, under whom I had the honour and advantage of studying.

Foramen of Monro.

Arteries of the Corpus Callosum and Hemispheres.

In this stage of the dissection, the operator may satisfy himself respecting the inferior artery (*d*) of the hemispheres, and the superior artery (*e*), which are the extremities of the anterior cerebral arteries, (Plate XV. c). These pass upward by the anterior cerebral fissure on each side of the falx, and are diffused on each side of the corpus callosum, and the vertical walls or region, as represented in this view. When the lower margin of the wall is elevated, where it joins the great vessel (*d*), the corpus callosum on the right side will be discovered as a distinct surface, connected with the hemisphere on which the reflected margin of the wall rests[2]. The outline (z) points out the site of the hippocampus minor, (†) the hippocampus major, (*) the digital cavity, to be shewn in the next plate, of which this forms the ceiling, and which is to be dissected out as the next plate exhibits[3].

[1] This body has its name from the structure of its parts; it is cineritious externally. When a vertical section is made, as in Plate XII. Fig. 2d (y), an arborescent arrangement of medullary and cineritious matter seems observable, the root inferior, and the branches directed upward. The same observation may be applied to the portion on the outside of the hippocampus major.

[2] The hemispheres are connected to the corpus callosum, therefore, the whole length of the lower margin of the falx (Plate VIII. i), supposing the line drawn about a quarter of an inch beneath the inferior longitudinal sinus, as pointed out Plate XIII. §, Fig. 2d.

[3] The right hemisphere may be removed in the following manner, viz. Form a transverse section in the middle of the hemisphere, about (d), and continue this down to the fornix (l); next carry a horizontal incision from the posterior or anterior portions, thus raising the anterior or posterior half of the ceiling of the ventricle. This affords an instructive view not only of the component parts of the hemisphere, but likewise the connections of the hemisphere, corpus callosum, and septum, which last appears a double lamina. It assumes a pear shape, the bulb anterior, and is sometimes bluish in its tint; in other cases it appears

PLATE X.

The Fornix.

THIS plate represents the fornix, which separates the ventricles. The relics of the septum appear connected with its middle. The extremities of the fornix may be traced as connected with the corpus callosum. The fornix forms the lower and middle portions of the vault, which is diffused over the middle of the ventricles. It is a double body, and may be divided into its anterior crura (w), its body (h), and its posterior crura (*w*), which divaricate from each other. The posterior appendage (z), is named hippocampus minor; the anterior and larger (d) hippocampus major [1]. The lower termination of the hippocampus is covered by the plexus, which answers as a guide for tracing its place and extent [2]. The posterior or digital sinus (*) is often much enlarged, so as nearly to meet its fellow in some cases. This seems the consequence of disease, and is frequently empty, notwithstanding its enlargement. This distention posteriorly is often attended by the appearance of a second pes, which seems occasioned by the prolongation of the digital sinus by contained water; it is placed by the outside of the great hippocampus, when present, and has no regular plexus as the former. Previous to exposing the body beneath the fornix, this last may be cut transversely, near the anterior cornua, to exhibit its inferior surface, as represented Plate XI. d.

white, and is occasionally the seat of dropsy, and has on this account by some been named the 5th ventricle, or fossa sylvii. When this view is taken, the other half of the hemisphere may be removed, as in the next plate.

[1] Pedes hippocampi—cornu ammonis. This descends to nearly the bottom of the middle cerebral lobe. This may be named the inferior region of the lateral ventricles.

[2] As the outline of the last plate exhibits. The hippocampus major has an inverted fimbriated margin (w), deriving its name from its structure, and indeed the pes may be raised considerably from its floor without violence. This body penetrates obliquely to nearly the lower margin of the middle cerebral lobe (Plate XIII, z). The band described by the ingenious Vieq d'Azyr, connected with the fornix, seems not always present. I have in every respect avoided minutiæ, which, not being regular, seem not connected with phenomena.

PLATE XI.

The inverted Fornix, Velum Interpositum, &c. *in situ.*

THE inverted fornix (d) exhibits the transverse lines (g) distinguishing its lower surface, deriving the name of Psalterium or Lyra, from its supposed resemblance to the stringed instrument of the ancients. The velum interpositum (i) [1], is discovered by this section, formed of a duplicature of the pia-mater derived from the adjacent lower surface of the posterior lobe of the cerebrum and the superior cone of the cerebellum. This composes at once the envelope of the vessels of the velum, and the pia mater which covers the ventricles. The arteries of the plexus (Plate XV. Fig. 2d, ||) are continued from the middle and posterior cerebral arteries, (d p). The vena galeni (k) terminate in one common trunk, to be inserted into the torcular herophili (c), represented likewise in its profile (Plate XIII. Fig. 2d, e), receiving the vena galeni (i) into its cavity. The right posterior lobe of the cerebrum (o) is removed, to bring the cone (p) of the tentorium, on which it rested, into view. This rises nearly an inch and a half into the sphere of the cranium, where a wound inflicted would penetrate the cerebrum and cerebellum.

The velum may be removed from its anterior adhesions to the ventricles, as represented in the next Plate, X. This requires to be cautiously performed, as the third ventricle, (Plate XI. Fig. 1st, x) is apt to be thrown aukwardly open if the velum is rudely elevated, and the pineal gland (Plate X. Fig. 1st and 2d, e) is liable to be torn from its situation if this care is not observed; as numerous vessels pass from the velum into its substance, which form a more powerful adhesion to the velum than its peduncles do to the adjacent bodies, with which we shall find it connected.

[1] Tela Choroidea.

PLATE XII.

Cone of the Cerebellum, and Inferior Bodies of the Ventricles.

In Fig. 1st, the tentorium (y) is thrown up to expose (g h i) the cone or superior portion of the cerebellum[1]. The velum is likewise thrown up, which may be traced as a continuation of the pia mater, from the inferior surface of the posterior cerebral lobe (z), and the pia mater of the cerebellic cone (g). The tense and large receptacles of the venous blood are conspicuous, viz. The longitudinal sinus[2] (a), inferior longitudinal sinus (b), torcular (c), and lateral sinus (*), which have been particularly described. The superior arteries of the cerebellum (h) are here represented, which are the extremities of the superior cerebellic arteries (Plate XV. Fig. 2d, o), and their corresponding veins (i) are discovered entering the lateral sinus (*).

Corpora Striata.

The velum being removed, the bodies composing the lower region of the ventricles appear, and are referred to by the outline, Fig. 2d, viz. (t m n), is the corpora striata, forming somewhat of a pear shape, cineritious externally, internally formed of an arborescence of medullary and cineritious matter, in the vertical section (y) recommended in cutting down to the hippocampus; (Plate XI. d) but the careful observer will discover the same arborescence on the outer side (z) of the pes.

Thalami Nervorum Opticorum.

The thalami nervorum opticorum, (o d p q), have their bulbs posterior; though I have met with cases where the bulbs were anterior. They fill up the space between the corpora striata[3], and compose invertions of the corpora striata. They are medullary ex-

[1] The substance of the cerebellum is divided into numerous sulci, as represented in this, and its lobes, Plate XV. The cerebellum consists of its superior cone and inferior lobes. The vermiform appendages mentioned by authors seem not always present.

[2] See Plate XI.

[3] These four bodies composing the floor of the ventricles, as well as the corpus callosum and septum, are very various in their dimensions in different subjects. And as the Brain is a premature organ in man, they soon acquire their full size. In an idiot I discovered them to be very small. She had strabismus from infancy, and had laboured under hydrocephalus internus, as the cavity of the ventricles originally contained half a pint of fluid, half an ounce only remaining. The falx was completely absorbed, and the adjacent portion of the tento-

ternally, and internally cineritious. An anterior eminence (p), and a posterior (o), are very conspicuous; these are covered by the fornix, and have the name of corpus geniculatum externum et internum. The junction of the thalami (q) has received the name of commissura mollis, though with no seeming propriety, as there is little continuity, if any. The crura fornicis anterior (w) are bent forward to exhibit the anterior commissure of the cerebrum (t), which has the appearance of a dense transverse white cord, which unites the hemispheres. Directly behind this the vulva[1] (s) is discovered. This opening is the communication leading from the ventricles to the infundibulum, a cineritious conical or infundibuliform body (Plate XXV. q), inserted into the pituitary gland, (Plate XIV. Fig. 1st and 2d, i). At the posterior portion of the ventricle, a similar opening may be observed, named anus, Fig. 2d, (r)[2], which is shut up by the velum, behind which a posterior transverse cord (v) is situate, named posterior commissure of the cerebrum. The pineal gland, (c), is sustained partly by this last body, and is partially attached to the nates (e) by a slender peduncle; but the anterior peduncle (d), represented in the plate, is

Anterior Commissure.

Vulva.

Infundibulum.

Anus.

Posterior Commissure.

Pineal Gland.

rium, where a tumefaction of the cerebellum appeared. The optic nerves were unusually slender. The spine of this woman was much distorted, the constitution puny, the mind imbecile, the temper very peevish and jealous. Her appetite for food, (as often may be observed in patients labouring under diseases or injuries of the brain) was very voracious. Another idiot had similar small bodies composing the ventricles. This morbid hunger seems a very universal state of feeble subjects, and would appear to depend on the action of the gastric fluid on the languid state of the stomach, of which healthful hunger would appear a species, though more easily allayed. Does death-hunger, as it is vulgarly termed, support this opinion? In the fevers of America, wherever a patient expressed sudden and violent desire for food they never lived; they often died with the bread in their mouth, mingled with the blood which flowed from their gums and nostrils. On the contrary, while active fever is assumed, the irritable state of the stomach rejects food. I observed the most salutary effects take place frequently (when the stomach and brain exhibited the most morbid symptoms), from applying to the forehead a number of layers of a towel, wrung out of cold water, and this cold kept up. In such cases, cold affusion was inadmissible; the stomach revolted at every application; the gentle stimulus of the cold was diffused, and the stomach was allayed in its irritability. Vapour-bath had a similar effect.

[1] Foramen commune anterius; iter ad infundibulum; iter ad tertium ventriculum.

[2] Foramen commune posterius.

large and conspicuous, uniting itself to the thalamus and anterior crura fornicis. The appearance of this body, as all the cineritious parts of the Brain, varies very much in different subjects; when healthy, it is cineritious externally, and medullary internally, and is rarely found free from gritty matter in the adult Brain. I meet with it much enlarged, and occasionally in a cartilaginous state. Des Cartes has supposed this body peculiarly connected with mind, but there seems no solid ground for this hypothesis.

Nates. The nates, (e)[1], are two bodies deriving their name from their resemblance to those bodies in the human subject; they are medullary externally, and cineritious internally. Beneath, and a little more posterior, are found two transverse bodies (f), likewise deriving their name from a resemblance to the testes[2]. The depending region of the ventricles (*) have received the name of anterior sinus, and the posterior triangular cavity (b) posterior or digital sinus. A section of the commissura mollis (q) and the corpora quadrigemina being formed, the third ventricle, represented Plate XIII. Fig. 1st, is brought into view.

Testes.

PLATE XIII. Fig. 1st.

Section of the Cerebellum, Third and Fourth Ventricles, &c.

Iter ad Quartum Ventriculum.

The anterior crura fornicis (*) are laid back, to exhibit the sections of (a) the anterior commissure of the cerebrum. The iter ad infundibulum (†), the third ventricle (x), section of the posterior commissure (b), the pineal gland (c), and its peduncle (d), the nates (e), and testes (f), (§) the iter ad quartum ventriculum, which is formed by the cavity of the corpora quadrigemina, the valvula Vieussenii (g), fourth ventricle (h), or stylus scriptorius[3],

[1] Anterior eminences, anterior tubercles, larger in brutes than man; they seem more cineritious externally in some animals than man.

[2] Posterior eminences—posterior tubercles. These four bodies have been named likewise quadrigemina. The observations connected with the nates seem to apply to these bodies.

[3] This cavity is continued to the termination of the medulla spinalis in many of the mammalia, but in the human subject it is shut up here by the pia mater. The third and

arbor vitæ (k),[1] springing from the pedunculi cerebelli (l), corpus striatum (m), thalamus nervi optici (n).

Recapitulation.

The ceiling of the ventricle is composed of the centrum ovale, corpus callosum, septum lucidum, and fornix. In the lower region of the ventricles are found the velum interpositum, pineal gland, the vulva and anus, anterior and posterior commissures of the cerebrum, thalami nervorum opticorum, tænia, corpora striata; behind are the nates and testes. Beneath the commissura mollis is the third ventricle; its anterior cavity bends downward as the iter ad infundibulum, and posteriorly it terminates in the iter ad quartum ventriculum.

PLATE XIV.

Base of the Cranium; the Nerves, Vessels, and Sinuses retained *in situ*, on the left side; the bones represented bare on the right.

In this plate, Fig. 1st conveys a notion of the internal base of the cranium, which receives the corresponding portions of the base of the brain, which is represented Plate XV. Fig. 1st. Fig. 2d is an outline of the vessels and nerves. The vessels and nerves have the same references annexed to them in this figure as those of the brain, Plate XV. Fig. 2d. The nerves are easily understood, from being pointed out by the figures 1, 2, 3, as they lie in order. On the left side of Fig. 1st, the dura mater is supposed to be retained with the nerves entering their sheaths, and the sanguineous sinuses are represented in their place; on the right, the bones are represented as stripped of the dura mater, that their site, parts, foramina, and osseous fossæ or sinuses, may be the more clearly discriminated.

Fig. 1st, The receptacles of the cerebral and cerebellic lobes have the same references as those in Plate XV.

fourth ventricles seem real cavities even in health, and probably answer such purposes as we find in the brute tribes, where other bodies in their brain have ventricles. It is very remarkable, that, in the human species, these seem little affected in hydrocephalus internus, and other diseases of the brain; they still assume nearly their usual and healthy capacity.

[1] Here the pia mater (o) is seen covering the sulci of the cerebellum, and following their course.

PLATE XV.

Base of the Brain.

Fig. 1st is meant to represent not only the base of the Brain, but a little of the rotundity of its hemispheres. Fig. 2d is its outline, with references to its various parts, arteries, and nerves: the nerves are distinguished by the figures 1, 2, 3, &c. as in the marginal notes. The anterior lobes (x) are concave, corresponding to the convex bones on which they rest. The fissura magna anterior (v), corresponding to the little wings of Ingrasius, and the fissura posterior (‡), correspond to the angle of the pars petrosa (Plate III. Fig. 2d, v), the middle cerebral lobe, (r u t q z), the posterior lobe (†), the lobes of the cerebellum (§), the pons varolii (m n o) its connections with the crura cerebri (u), the crura cerebelli (w), and medulla spinalis (k). Their arterial appendages, it is presumed, will be sufficiently evident by an attention to the plate and references already enumerated. The infundibulum (q) is the cineritious termination of the third ventricle, which conducted to the pituitary gland, (Plate XIV, Fig. 1st and 2d, i.) The corpora albicantia, or eminentia mammillaris, (t,) are lentiform bodies, medullary externally, and striated with cineritious matter internally [1]. Behind these bodies, and between them, the cineritious substance, which unites them and the crura cerebri, has the name of pons Tarini. The crura cerebri (u) [2] are composed of distinct medullary bundles externally, uniting the cerebrum and pons. Their internal substance, appearing darker in some instances than the rest of the cineritions, has received the appellation of locus niger crurum cerebri. The same is observed of the crura cerebelli (u). The pons has numerous striated portions internally, Plate II. Fig. 4th. [3] The foramen cæcum

[1] I find them occasionally of a pear shape and very large.

[2] These bodies escape from the pons varolii (which rests in the cavity, Plate XIII. Fig. 2d, c), and, passing over the foramen ovale duræ matris (e), unite with the cerebral lobes.

[3] See Section, Plate II. Fig. 4th.

anterius (r), and posterius (s), situate before and behind the pons, seem to become the anastomosing nidi of the external vessels and those of the ventricles. The medulla spinalis is composed of four pillars, which are medullary externally, and cineritious internally, viz. two columns (v) named eminentia, or corpora pyramidalia; and two lateral bodies, the eminentia, or corpora olivaria (w). Two other bodies have been described by authors, on the outside of the last, to which they have given the appellation of corpora pyramidalia lateralia; but they are often indistinct, as well as the vermiform appendages of the cerebellum, which are placed on the anterior and posterior portions of its lobes[1].

Particular Description of the Arteries within the Cavity of the Cranium.

The arteries which supply the eye, the nostril, the ear, and the brain, are derived from the carotids and vertebrals. The internal carotids, (Plate III. Fig. 1st),[2] which form the anterior vessels of the brain, enter the syphon-shaped canal of the pars petrosa[3].

[1] The Cerebrum is that organ where ultimate material operations take place, and which are taken notice of by the soul. The cerebrum seems passive in this respect, as well as its nerves. We seem to trace the various phenomena, named ideas, connected with sensation, as secondary consequences of arterial action, so far as sensation is connected with reflection. The cerebellum seems principally appropriated to animal purposes; and while this organ is exaggerated in the brute, the cerebrum is proportionally small. Brutes possess large external organs, as the eye, &c. a small cerebrum, and a large cerebellum. Man, on the contrary, has a large cerebrum, small external organs, and a proportionably small cerebellum. The explanation of mental and corporal phenomena, where the brain and nerves are concerned, seem still connected with great difficulty. We often detect great heat and pain in a paralytic member: we discover a power of motion occasionally, without any cognizance of sensation. But may not muscular matter retain a power of contraction, when the power of the arteries connected with the nerves fail to promote cognizance?

[2] I have not added a diagram of the vertebral in Plate III. Fig. 3d, as it would occasion confusion, but its course is seen internally.

[3] Plate III. Fig. 3d (2 a) represents this syphon as viewed through a transparent medium: (a b) its ascent from the syphon to the posterior clinoid process; (b) its horizontal situation in the carotic sinus of the sella; at (c), it is embedded in the hollow of the anterior clinoid process, and sends off (d), the ophthalmic artery; (f) is the anterior cerebral, (e) the anterior communicans, (g) middle cerebral, (l) basilary, (k) inferior cerebellic, (m) anterior or superior cerebellic artery. The relative situation of the other arteries are understood, having the same references as Fig. 1st; (l) is the jugular vein in both figures; in

After they escape from this situation, they pass obliquely upward, along the posterior clinoid process of the os sphenoides, (Plate XIII. Fig. 2d, r); they emerge into the cavernous sinus, (r c); and, upon their leaving this to enter into the cavity of the cranium, they send off the ophthalmic artery, (Plate XIII. Fig. 2d, b,—Plate XIV. Fig. 2d, b,—Plate XV. Fig. 2d, b.) This artery passes from the anterior portion of the carotid, enters the foramen opticum of the sphenoidal bone (Plate XIII. Plate XV. Fig. 2d, b,) with the optic nerve (2). After entering the orbit, it supplies the lachrymal gland, the eye, its muscles and the nostril, by the anterior and posterior ethmoidal foramina, (Plate II. Fig. 3d, q), the palpebræ and forehead, (Plate III. Fig. 1st, 17). The lateral communicating artery, (Plate XIV. Fig. 1st and 2d, e,[1] Plate XV. Fig. 2d, e,) passes backward to join the posterior cerebral artery (Plate XIV. p); the anterior cerebral artery (Plate XIV. and Plate XV. c) is inclined forward: at (c) there is found an anterior transverse communicating portion which unites them, as the lateral branches do the carotids and vertebrals[2]. The middle cerebral artery (Plate XIV. Plate XV. d) seems the continuation of the common trunk of the internal carotid; it enters the middle lobe of the brain (Plate XV. d,) supplying its substance. This vessel, and the posterior cerebral artery (p), send off the arteries of the choroid plexus (‖), where they are discovered to anastomose with each other, and the external vessels of the foramina cæca, (r s.) The vertebral arteries, (Plate XIV. Plate XV. Fig. 2d, i,) after leaving their individual connection with the atlas, incline toward each other, meet in an angle at the pons Varolii, and form one trunk, resting on the ossa cuneiformia, (Plate XIV. Fig. 1st and 2d, m o,) named

Fig. 3d, (m) is the contortion of the foramen lacerum, as it bends to be continued as (n o) the segment of the pars squamosa (Fig. 2d, u).

[1] I have met with a case where this artery was wanting.

[2] These pass by the anterior fissure (c) of the cerebral lobes, on each side of the falx, (Plate XI. d i h), and become the arteries of the corpus callosum, (Plate VIII. *d e*; the posterior spinal arteries arise from the anterior cerebral.

the basilary artery[1]. The anterior or superior artery of the cerebellum, (o) surrounds the tuber in its route to the cerebellic cone, (Plate XII. h.) The last vessel of the basilary is the posterior cerebral (p.) The circle of Willis is formed by the anastomoses of the anterior cerebral arteries with each other; by the communication of the transverse artery (c); and by the anastomosis of the lateral communicating (e) with the middle cerebral (d), and the posterior cerebral (p).

General notion of nervous economy.

The nerves are sent off from the basilary appendages of the brain. They are white cord-like bodies in general, medullary externally, cineritious internally[2]. A nerve, when properly in-

[1] The anterior spinal arterics (k) are seen passing from the vertebrals; they unite within the skull, and are continued to the lumbar region, where the lumbar arteries take up their office. The inferior artery of the cerebellum (l) comes off from the vertebral, as seen here, or the beginning of the basilary artery. The auditory artery (n) is often very large, and enters the foramen auditorum internum, with its nerve.

[2] The brain is a double organ in its parts, though the cerebellum and pons Varolii seem more of a connected texture than the other parts of this organ we have been describing; hence perhaps the deleterious effects, when these parts are injured, from an absence of analogous agency. I would be understood by this term to mean, that these organs have single offices, and no organ which assumes their function, in case of their failure. We find the heart, skin, stomach, intestines, and urinary bladder, mutually relieving, and occasionally injuring each other. Except the heart, spine, chylopoetic viscera, urinary bladder, urethra, &c. most of the organs are in pairs, and the nerves are sent off in pairs; even the spinal marrow may be considered as double. I shall, however, in describing the nerves, use the singular number, as the idea of complexity attached to the word first, and second, and third branch of the fifth pair of nerves, seems to embarrass the student. The dissector will observe, that the nine nerves issuing from the base of the brain, are by no means very vascular: on the contrary, the medulla spinalis and its arborescence are highly vascular. The nerves of the finer senses, however, are accompanied by large vessels, which are profusely distributed on their external organs, as the media of the actions taking place in these organs; these actions being communicated by the living vessels to the brain, through the medium of their nerves. We observe that, in many cases, the nostril, eye, ear, and tongue, perform their common animal functions in man, when intoxication, delirium, &c. have suspended their cognizance by the mental functions: Thus animal informations continue unimpaired (and animal preservation is secured), and are no farther taken notice of than they serve animal purposes, where the mind is occupied in the dream, connected with morbid action in the organ immediately connected with reflection. The hurry and monotony of the madman, is therefore as full a proof of the wise and unerring laws of nature, connected with sensation and reflection, as the arranged ideas of the profound philosopher;

jected, is a complete congeries of vessels; an artery insinuates itself at different distances into its internal substance, which anastomoses with the external vessels; these former vessels contract

they are both drawing inductions, corresponding to the state of their organs.—Does this throw light on the structure and phenomena of the lower animals? We do not observe what may be named fatuity, delirium, or madness, in brutes: (hydrophobia or rabid affections cannot rank among mental disorders). Objects which every moment charm or disgust human beings, are unknown, unheeded by the brute, who accepts of Nature's gifts as they are presented to him, and has no imagination to lead him to transgress her rules. Man, on the contrary, from the state of his ideas, depending on his peculiar organic structure, is liable to the most deleterious affections, from excitement of mind, which operates as the most powerful stimulus on the corporeal system. To be convinced of this, we have only to advert to the sudden convulsion which any passion occasions in the human frame. In proportion as affluence and freedom become the lot of man, we discover derangements of mind extending themselves. When we attend to man under different situations in various countries, we can clearly trace maladies, not necessarily flowing from human nature as a machine, but human nature altered in her physical structure by moral turpitude. Mania is by no means so frequent in arbitrary governments, where the mind is cramped, as in free states where it is unhampered. Maladies of an acute, chronic, and even of a mortal type, affecting the organs of sense, rarely induce discomposure of the brain. This notion may, in many cases, be extended to even the vital organs, which, though highly vascular, have small nerves, no voluntary action, and comparatively little muscular matter connected with their apparatus. On the contrary, the functions of the brain suffer great derangement where disease or injuries of the trunk or limbs take place; where large masses of voluntary irritable muscle are affected, numerous membranes and vessels are concerned, and their actions are communicated through the medium of the medulla spinalis. The nerves are agents, intervening between the material world and the soul. Wherever we view the animal machine, the action communicated to the heart or arteries seem ultimately impressed on the nerve, and thence to the sensorium commune. The office of muscular fibre seems action. We discover the heart pulsating, though torn from its cavity and nervous appendages; and the whole mass of muscles of an animal, after the head is separated, shall tremble for a time by the stimulus of the atmospheric fluid, or the application of a pointed instrument. The office of the nerves seems that of reception of actions. All sensations seem modifications of touch. When you apply the tip of your finger to an object, that object affects the living vessels, the action of which is impressed on the nerve, and thus communicated to the brain. Since arteries are formed of a congeries of muscular annuli, and muscles contract on application of stimuli, (nerves being composed of medullary and cineritious matter, interwoven with living vessels) these communicate the action to the nerves, which correspond to the impingence received by arteries, from material or intellectual influence. The shock of a thought becomes occasionally as fatal as the flash of lightning. The same observation applies to the other senses, which are touched by their appropriate objects, as the eye, &c. These convey or do not convey sensation, as bodies adapted to excite them are applied. The same applications and actions, however, which occasion sensation, may have being, and no

when experiments are performed on these organs (of which we cannot bereave a nerve), and deceives the experimentalist, who supposes a nerve contracts. Indeed, the most powerful vessels are

sensation take place; which seems to afford a clear demonstration between mere life and action, and intellectual operation; and proves that, however material organs may render us acquainted with a material world, these organs, as well as the objects impressed on them through the medium of their structure and offices, are known to us only through the medium of the soul. When we investigate correctly these physical and intellectual phenomena, their true and distinguishing characters seem so unequivocal, that we must be surprised that so many great men should, by listening to preconceived opinions, embrace contrary and absurd extremes, by neglecting to look at nature, and failing to revere religion. Motion and ideas are both realities; they are each distinct consequences of matter and intellect. Pain and pleasure of body are as much intellectual operations, dependent on connection with material organs, as compunction or self-approbation are purely intellectual results, flowing from the laws of our Maker, written on our mind. Whatever is discovered by human nature, physically or intellectually, becomes so from the presence and attention of soul. If I agitate the point of your finger, you complain of titillation; but when you are sound asleep, though the same irritation may be applied, and yet be unfelt, the same exciting cause, as well as its corresponding physical arterial action, has taken place. Does this lead us to a key, by which may be opened the mysterious fact, of the distinction between body and mind? The person who reads this is all over alive; his wonderful fabric is a thrilling being, suspended between life and death; of this fabric, however, at this moment, he has no cognizance, if in health. The mind has no cognizance of absolute healthy action, till excitement takes place. Deep and mortal wounds communicate little or no sensation, though inflicted even on the hemispheres of the brain, till morbid action occasions cognizance: a proof of sensation having being where nerves are not concerned. If you read this subject with attention, your right hand, as well as every other part of your corporeal system, is unknown to you, till I brought you to recognize this circumstance, that you are possessed of organs of which you are not conscious: But you had complete cognizance of the subject before us, and that alone. The actions therefore necessary to sensation seem to depend on a certain state of motion in the vessels, without which there is no cognizance. Mere life and health is a consequence of arterial action, unconnected with cognizance. Sensation of pleasure seems a gentle agitation of the vessels and nerves, and pain an inordinate convulsion of the same organs, both of which are taken notice of by the soul. Disease, therefore, is a continual cognizance of morbid action; and even excess of lawful action predisposes to disease. Physiologists have long observed that bones, membranes, ligaments, &c. communicate no sensation; but, in fact, there is no sensation in any organ where the vessels are purely carriers of lymph, which is the case in all those parts named insensible, and which you perceive by your own system is the case even respecting the muscles you use every moment. The weariness of the evening, therefore, seems the dawning of muscular debility. Continue to shake off sleep: you may, perhaps, to usher in that febrile debility, which may for ever debar the slumbers of health. Numerous diseases are founded on an inattention to natural indications; but all the animal organs communicate the most acute anguish when their

those which no human art can discover, and which imagination alone can conceive. White muscles are even the most powerful, *i. e.* those supplied immediately by coagulable lymph, of which

lymphatic arterics carry red blood, which seems synonymous with relaxation, dilatation, and consequent increased action. This observation respecting insensibility applies to all parts of the system in health, as experience demonstrates; and the sensibility of the organs of vision, &c. seems to arise from their vessels being laid bare to their appropriate stimuli. Hence the cuticular organ has an insensible dead film (the scarf-skin or cuticle) thrown over its living vessels, to prevent these delicate agents from receiving too much agitation. Thus a healthful being is an agent void of involuntary feeling; (i. e.) it is a system of organs, in a legitimate state of tone, which feels, or does not feel, as objects are or are not applied to it, or as the soul does or does not attend to these physical actions; a healthful body therefore is a being active and void of feelings, but such as the soul attends to; and disease, as we have observed, seems no more than a relaxed modification of the muscular economy, which compels mental cognizance. We proceed in the busy scenes of life, during a whole day, not conscious of the organs we are using, except when we direct the mind to them, till the evening, when the pain of weariness commences; and even this is banished from our sight by the balmy function of sleep, connected with that state of the brain which precludes cognizance. Slumber, on the other hand, seems some wise catenation, by which muscular power is preserved, by the suspension of mental cognizance, which leaving the living organs to their own physical process of action, the loss of tone induced by mental influence is restored. Whatever threatens the legitimate power on which life and vigour depends, induces sleep; if not so violent as to promote that debility which terminates in fever. Thus, intense thought, passions, intoxication, applications of wet, cold, heat, violent exertion, even a full meal acting as a stimulus, fatigues the muscular system; the arteries fail to propel the blood through the veins of the brain; congestion takes place, and sleep commences; that function, of which apoplexy, water in the ventricles, or any compression of the cranium, seem the morbid excess, as fever is the morbid excess of healthy action. During healthy sleep the system acquires tone; it is merely alive, the mental principle in its powers of cognizance being suspended, that this mortal frame may recover the shock of mental influence, which cheers and invigorates the system, when regulated by the laws of nature (synonymous with those of religion), but which, by any violence, is subverted and changed, warning the physician in many cases how to cure by mental influence. Madness, we must hope, may yet be more successfully treated than it has hitherto been. All mental derangements seem to depend on that state of the brain, which continually attracts mental cognizance to the waking dream, induced by the state of the vessels. The operations of the soul may be considerably extended and diversified when connected with a healthful body; but in disease, this is relinquished, especially when the instrument (the brain) more immediately taken notice of by the soul is in a morbid state. The harsh measures, too generally used in such cases, are calculated to put a wise man mad; though some practitioners, on this account, suppose such modes adapted to bring madmen to their senses. We see the victim of delirium too often dragged from the abodes they recognize, and the domestics they love, to a cell, the solitary horror of which is increased by a cruel keeper.

the muscles of the vesiculæ seminales and some fish tribes are instances; and in our preparations injected with wax, although the small vessels are as much distended in proportion as the larger trunks, yet, while the larger trunks rupture by expansion of the wax in warm weather, the small vessels continue to retain their contents.

The first Pair of Nerves (1).

The nervi olfactorii, are observed emerging from the brain at the posterior portions of the anterior cerebral lobes. They are continued forward, and appear somewhat cineritious where they become bulbous. This bulb (1) rests on the cribriform plate of the os ethmoides, (Plate XIV. Fig. 1st 1.), where they split into

Lucid intervals often occur in a moment, like the electric spark. Healthy action is assumed. What must be the feeling of a tender female, or a high-spirited man on this occasion? Do things around him promise to sooth dawning health? or rather to render him a patient for life? These animadversions are drawn from conversations of the afflicted individuals after return to a sound mind. In all such cases, the mind ought to be roused by gentle and amiable means if possible; they should be decoyed from the theme which entangles and unhinges them. David played on the harp before his persecutor Saul, who became convalescent by this means. I could adduce instances of the influence of misconduct in fever as well as madness, so far as mind operates on the body. An important secret in the healing art, seems to consist in that active and correct practice, which cuts short the deleterious process of morbid action which terminates in chronic malady. When the brain is immediately concerned, the senses ought to be attracted by pleasing objects, or lulled by some means. The removal of a madman, or person in the delirium of fever, from his room or habitation, often becomes the exciting cause of the caprice of an oppressed brain. I have witnessed the sudden and continued presence of a tender friend, light, sounds, effluvia, &c. for ever banish convalescence. The senses, when they do not renovate, seldom fail to irritate the system in such cases. In the lungs and other viscera, where we easily trace and compare, healthy and morbid states evidently depend on new arrangements and structure of the vessels; the bronchial, intercostal, and internal mammary vessels, which in health discharge distinct appropriate functions, and have no connection with each other, in disease anastomose; form dense matter in the substance of the lungs; lubrication and motion of the viscera are relinquished, and adhesions, with the other morbid attendants take place. Similar derangements probably take place in the brain by inert practice, though not so easily detected by us, which for ever renders this organ an imperfect instrument of the mind. Epilepsy, and other organic affections, I have been fortunate enough to divert, anticipating the paroxysm by rousing the system by cold affusion, or operating upon the feelings of the patient; and in such cases the improvement of the system, and such mental phenomena as immediately depend on it, seemed to warrant the inductions I have offered on this difficult subject.

numerous more dense nervous filaments, that escape by the foramina of this plate, to be diffused over the schneiderian membrane of the septum narium, and the os turbinatum superius of the os ethmoides (Plate III. Fig. 2d, *e*). This bone, though composed of convoluted surfaces in the human subject, admitting an extensive surface in a small given space, yet, compared with other animals, the nostril distinguishes man as possessing very limited animal powers [1]; the olfactory nerves seem not extended to the inferior region of the nostril, composed of the os turbinatum inferius[2]. These nerves are so tender in man, that they are torn from the cribriform branches in raising the anterior lobe, unless great care is observed by the operator.

The Second Pair of Nerves, (2).

The nervi optici, are observed proceeding from the brain, uniting with each other, and again divaricating toward the foramina optica of the os sphenoides (Plate XIV. Fig. 2d, a), where they are accompanied by the ophthalmic artery (b), to become the organ of vision, in consequence of the hollow sphere of nervous matter, which receives impression in all directions, through the medium of the lenticular apparatus placed before it. This nerve can be distinctly traced to the ciliary circle of the iris [3].

[1] The olfactory nerves are very large in some brutes; and the bones of the graminivori and carnivori, which receive these membranes and nerves, are not only so extended, but likewise diversified in their shape, as to suit them for their different offices. In the graminivori they form extensive scrolls; in the carnivori they are infinitely folded. Their funnel shape seems to admit a large quantity of effluvia at the external extremity, which becomes concentrated in its course toward the brain; mucus continually lubricates this membrane, which predisposes the vessels to be accurately affected by effluvia. Does a chemical property in this fluid occasion its more immediately uniting with substances?—we perceive how inert a dry nostril is. The same observation applies to the saliva.

[2] The membrane of this bone in all animals seems the guardian organ of the olfactory system: in the brute it is comparatively small. We shall find it principally supplied by the fifth nerve, which is distributed as the nerve of common sensation to the eye, nostril, ear, tongue, and face; we therefore discover pain, a sense of heat, cold, dryness, soreness, &c. distinct from the sense of effluvia, seeing, hearing, or tasting.

[3] As I introduced an easy manner of tracing the various parts of the eye by dissection, a great number of years since, and which seems not hitherto well explained by others, I

The Third Pair of Nerves, (3).

The nervi motores oculorum, are seen passing from the crura cerebri near the pons Varolii, between the posterior cerebral and superior cerebellic arteries. They enter the cavernous sinus, (Plate XIV. Fig. 1st and 2d, 3). Here they are surrounded by the dura mater, which forms its sheath, around which the blood in the sinus is circulated. These vaginalæ are kept tense by tendinous bridles, which occasions this cavernous appearance [1]. The nerves, after escaping by the foramina lacera of the os sphenoides to the orbit, are distributed to the levator, depressor, adductor, the obliquus inferior of the eye, and the levator palpebræ superior.

The Fourth Pair of Nerves, (4).

The nervi pathetici, or trochleares, arise from the testes. They do not exceed the diameter of a sewing thread. They are transmitted through the receptaculum or cavernous sinus as the last: (Plate XIV. Fig. 1st and 2d, 2d, 4) They are principally distributed to the superior obliquus of the eye.

The Fifth Pair of Nerves, (4).

[2] The nervi trigemini, so named from its being composed of three principal branches. The trunk is large and rather flat. It

shall here offer a few directions (though not duly in their place) for the developement of this complicated organ. I have annexed a figure (Plate XIII. Fig. 4th) to illustrate the parts. After extracting the eye-ball (a), from the orbit, open the vagina (b) of the optic nerve (c); form a triangular incision in the sclerotic tunic (d), extended to the lucid cornea (e); cut off the sclerotica along the circumference of the lucid cornea. This brings the choroid tunic (f) into view. Immerse the eye into a solution of alum, into alcohol, or common spirits, sufficiently strong; in a few minutes the choroid coat becomes so corrugated, as to be cut by the scissars. Open the middle of the choroid coat, the retina (g) is discovered. Again immerse the eye. This retina may be opened to exhibit (h) the capsule of the vitreous humour. Thus, in one preparation, all the component parts appear in their relations to each other, as they float in the spirits when put up for demonstration. If you wish to convey a notion of the aqueous chambers, cut off the one half of the cornea, leaving the other, as represented here; (i) is the pupil of the iris (k).

[1] The fourth, fifth, and sixth nerves have similar apparatus. The sixth nerve was formerly supposed to possess no vagina, and was thought to lie bare in the blood of the sinus. What then prevents the blood from passing thence to the cavity of the cranium by its sides? I demonstrated the vagina of this nerve many years since; but this cannot be convincingly done without injecting the sinus with soft wax, which absorbs the blood, and may be removed to exhibit the sheath.

[2] This nerve seems a prominent instance of sensations deriving their character more from their external organs, than their peculiar structure or connection with the brain. Its

arises from the pons Varolii, near the crura cerebelli. After penetrating the dura mater, as represented Plate XV. Fig. 1st and 2d, (5), the flatted ganglion gasseri sends off the three principal branches.

The first branch, or ophthalmic, affords filaments to the great sympathetic nerve, to be mentioned hereafter. After passing through the foramen lacerum of the os sphenoides, (Plate XIII. Fig. 2d, c), it follows the same course as the ophthalmic artery, viz. entering by the foramen orbitarium anterius (Plate II. Fig. 3d, q), it supplies the schneiderian membrane; it is likewise distributed to the lachrymal gland, the tunica sclerotica, choroidea, and iris of the eye, the periosteum of the orbit, the pericranium, (Plate II. Fig. 4th, i) muscles, and the integuments of the forehead, uniting with the portio dura (Plate II. Fig. 4th 7), and sub-occipital nerves, to be mentioned. The second branch of the fifth nerve, or superior maxillary, passes through the foramen rotundum of the os sphenoides, (Plate XIII. Fig. 2d, v); in its route it sends off the spheno-palatine nerve, the reflected branch of which enters the vidian foramen. This foramen perforates the root of the interior pterygoid plate, (Plate XIV. Fig. 3d, *), and unites with the great sympathetic, where this last passes by the foramen caroticum (Plate XIII. Fig. 3d, r) to the neck. A twig enters the foramen superius, or innominatum of the pars petrosa, (Plate XIV. Fig. 2d, y). This is bestowed on the membrane of

branches are distributed to the eye, nostril, ear, tongue, the bones, muscles, and integuments of the face. In all these distributions it is connected with the other nerves, viz. the olfactory, optic, auditory, gustatory, and portia dura. To the teeth and palate alone it goes singly, and these perform single and simple functions. A similar instance is evident in the radial and ulnar nerves, the trunks of which receive different impressions, as objects are applied to the posterior or anterior surfaces of the wrist, the hand, and phalanges of the fingers, where the integuments convey varied sensation, corresponding to the varied structure of these parts. The tongue, not the palate, is the acute organ of taste; and the fifth nerves seem, in all their distributions to the organs of sense, merely agents of common sensation. Their ramifications are annexed to the membranes of the various organs, while the peculiar organic nerve, as the optic, auditory, &c. is diffused on the organs themselves, in that profuse and peculiar manner, so different from the fifth nerve, as to indicate the difference of office.

the internal ear, unites with the portio dura, and forms the chorda tympani. The trunk enters the canal of the orbitar plate of the superior maxillary bone (Plate II. Fig. 3d), p, supplies the teeth of that bone, is transmitted to the face by the infra orbitar foramen, (Plate II. Fig. 4th, 2), where it supplies the adjacent bones of the face, the nose, lower muscles of the palpebræ, and those of the face and lips. The third branch passes to its destination by the foramen ovale, (Plate XIV. Fig. 2d, w). It supplies the tongue, is continued to the internal foramen of the lower jaw (Plate III. Fig. 2d, m), by its internal groove, where it is distributed to the lower teeth and the substance of the lower jaw, and is transmitted by the foramen of the chin, (Plate II. Fig. 4th, 3), to supply the substance of the lower jaw, the muscles of the chin and lower lip. All these branches unite with the portio dura, (Plate II. Fig. 4th, 7).

The 6th Pair of Nerves, ' 6.

The nervi abducentes, or motores externi, arise between the pons Varolii and the corpora pyramidalia. They enter the cavernous sinus beneath the 4th nerve, (Plate XV. Fig. 1st and 2d, 6). This nerve, previous to its ocular destination, unites with the first and second branches of the 5th nerve, composing thus the nervus sympatheticus maximus. It descends in the carotic foramen mentioned, to be distributed to its various destinations[r]. When its

[r] It escapes by the carotic syphon, (Plate XIV. Fig. 2d, k---, Plate XIII. Fig. 3d, r). Its course may be understood as through a transparency, (Plate III. Fig. 3d, (a 2); at *, its ganglion lies between the internal carotid and jugular vein. The vessels are here and Fig. 1st separated. They will appear *in situ* on the plates of the head and neck of next number.

The distribution of the 4th and 6th nerves to these ocular muscles, seem to support the supposition I have hinted at, respecting the indivisibility of mental cognizance. The motions performed by the eye, when the superior oblique or abductor are used, differ from all other regular actions of the system, as they continually act in unison with dissimilar muscles, supplied by dissimilar nerves; as this seems to facilitate the actions of the dissimilar muscles. Dissimilar muscles of the limbs, &c. are no doubt used occasionally at the same moment, but this requires practice when rapid motions are required. We observe little children striving with each other, respecting their alacrity in beating rapidly with one hand on a fixed point of their breast, while the other hand moves in a vertical direction from the neck to the belly. When the child attends to either hand, immediately the other hand discontinues the contrasted motion, and assumes the action of the one attended to. In this case, similar nerves are employed; practice brings them to perform dissimilar rapid motions with organs supplied by

trunk has entered the orbit, by passing through the foramen lacerum (Plate XIV. Fig. 2d, u t) of the os sphenoides, twigs of this nerve, the first and second branches of the fifth nerve, and the fourth and third nerves, form the lenticular or ophthalmic ganglion, which supplies the iris. This ganglion is situate on the outside of the optic nerve. The trunk is continued to become the nerve of the abductor muscle of the eye-ball.

The Seventh Pair of Nerves. '7.

The nervi auditorii. This name belongs properly only to the posterior portion, which is a soft large nerve. It arises from the crina of the stylus scriptorius, and emerges from the crura cerebelli and pons Varolii. It enters the meatus auditorus internus of the pars petrosa (Plate III. Fig. 2d, x). This becomes the proper nerve of hearing [1], being bestowed entirely on the internal sys-

similar nerves. We may observe the same phenomena in the progress towards proficiency which performers on the piano-forte display, in crossing hands as it is termed. In the eye, therefore, we find muscles of a similar nature, which act in unison, supplied with similar nerves; as the levators and depressors. Both are furnished with the third nerve; but when dissimilar muscles are intended to act in unison, as the abductor of the one eye, and the adductor of the other (that both eyes may bear upon the same object), we discover dissimilar nerves, or the 3d and 6th; so the superior oblique, which acts in unison with the inferior oblique, the 4th and 3d nerves are employed. Similar nerves therefore are employed in the case of similar muscles. Dissimilar nerves seem necessary to occasion instant similarity of action in dissimilar muscles, directed by an agent so indivisible in its operations as the mind. We were convinced, that our very persons were unknown to us, when we attended to other objects, &c. The wise simplicity of nature is discovered (where the fewest possible agents are employed) in the 3d nerve being supplied in conjunction with the 4th and 6th; dissimilarity in one nerve being sufficient, which less distracts the mind than if another nerve had been furnished. This plan of nervous distribution not being observed as the promoting causes of the actions of other dissimilar muscles, does not seem to affect the above suppositions, as the limbs and other organs require dissimilar, as well as united actions, which practice easily promotes. Such a distribution as we observe in the eye, must, upon the same principles, have destroyed the power of variety of action in the limbs; as this distribution seems to produce the effect of unison alone in the eye, and seems the means of unerring vision. In strabismus, both adductors are apt to act in unison from a failure in the abductor; and this fact seems to illustrate the suppositions I have offered respecting the intentions of dissimilar nerves supplying dissimilar muscles intended to act in unison. The observation more rarely applies to the failure of the 5th nerve. Does the origin of the 6th nerve make it more liable to compression from collections of water in the ventricles?

[1] Thus we discover the organs of smell, seeing, hearing, and tasting, are supplied by distinct

tem of the ear[1]. The portio dura, which lies before it (Plate XV. Fig. 2d, 7), passes into the foramen commune of the pars petrosa, (Plate III. Fig. 2d, x). It is continued through the crooked canal or aqueductus falloppii. Here it joins the 6th nerve, and forms the chorda tympani; escapes by the foramen stylomastoideum (Plate XIII. Fig. 3d, s), expands into the pes anserinus, which lies within the root of the styloid process, (Plate III. Fig. 2d, y), as the root of the nerves which supply the cheek, and unite with those of the face and occiput (Plate II. Fig. 4th, 7).

The Eighth Pair of Nerves, (8)

The nervi vagi arise from the corpora olivaria, in small surculi, which almost immediately form fasciculi, which may be considered their proper origin; from this the glosso-pharyngeus is sent off. The last, the nervus accessorius (11) and par vagum, escape by the foramen jugulare (Plate XIV. Fig. 1st and 2d, 8). It passes to its various distributions between the carotid artery (Plate III. Fig. 3d, 2), and the internal jugular vein (1) of this same figure. It unites with the fifth, the sympathetic, and supplies the larynx, pharynx, thyroid gland, and adjacent parts, the heart, lungs, &c.

The Ninth Pair of Nerves, (9)

The nervi lingualis arise from between the corpora olivaria and pyramidalia by various origins, as the last. These nerves unite and pass by the condyloid foramen of the os occipitis to the tongue (Plate III. Fig. 2d, w)[2].

nerves peculiarly appropriated to their single functions. The sensations of the integuments are very much diversified, as we experience in the palm, tips of the fingers, &c. While the most common plebeian enjoys all the finer senses, as seeing, hearing, smelling, and tasting, his touch of hand is blunted by the same causes which gave pain to the tender palm in the early periods, or to the delicate person, which by repetition augments the cuticular laminæ. Thus offending causes excite the processes which obviate injury. Not only are the parts of the foot, on which we rest, composed of numerous laminæ of insensible impervious layers of cuticle, in consequence of compression, but a cushion of fat is the physical consequence of these exciting causes. The same observations apply to the hand of the labourer; not, however, from a *vis medicatrix naturæ*, for nature does not think (as the language of some of the ancients would insinuate), but merely acts from fixed laws, interwoven in the system by a wise Creator, who has so formed organs, that their structure has a natural tendency to obviate injurious causes where they occur, and these tendencies continue inactive when not excited. See Note, page 22.

[1] The portio dura is situate in an anterior groove of the portio mollis, or nervus accousticus.

[2] We find three large nerves contributing to the complicated functions of the tongue;

The Sub-Occipital Nerve.

The nervi sub-occipitales (Plate XII. Fig. 2d, 10) arise by two or three origins, from the superior portion of the medulla spinalis, and are transmitted between the occiput and atlas, to supply the muscles of the neck, and unite with the nervous ramifications of the frontal nerves, and those of the portio dura, diffused on the temples.

Recapitulation connected with the Plates which have been described.

Eight bones compose the cranium. These defend and sustain the brain, admit its arteries, and transmit its nerves and veins by their appropriate foramina. Its internal membrane, named dura mater, becomes the internal periosteum of these bones, and the septa of the brain, as well as the envelope of the brain and nerves. The cerebrum is composed of the two superior hemispheres, corpus callosum, and the inferior lobes. The four ventricles and their appendages, the cone and lobes of the cerebellum, the pons Varolii, the crura of the cerebrum and cerebellum, medulla spinalis, their arachnoid coat, and pia mater; the arteries, veins, sinuses, and nerves of the brain have been enumerated[1].

while the simple, involuntary, and unceasing actions of the heart are sustained by the aid of one small nerve. Does the muscular and nervous appendages of the heart entitle us to suppose, that incessant action of such powerful muscles, in immediate contact with the blood, required only so much nervous matter as would convey cognizance, when deleterious relaxation takes place; and that the greatest vital action is realized, where there is least nervous matter?—demonstrating the independent line of distinction between action and sensation.: the heart being the most active, simple, involuntary agent supplied by small nerves; the tongue the most acute, voluntary, complicated agent, in consequence of its nerves.

[1] The reader will now recollect, that I have endeavoured to distinguish the various agents entering into the composition of the animal economy, so far as life and sensation is concerned, that we may the more decidedly assign to each their appropriate office, so necessary to unravel the equivocal system of animal being, viewed as a united whole. We discover life to depend on agents more or less continuing the same, while the vital organs, from conception to old age, undergo incessant change. Anatomy assures us, that the heart and arteries are the agents primarily undergoing these changes; that these are the organs on which the varied modifications of action depend; that, so far as intellectual operation is dependent on sensation, through the medium of the nerves and brain (where ultimate material operation is effected), the heart and arteries promote the fundamental basis of animal phenomena. While, however, during the animal existence of human nature, we are convinced of the influence of body on soul, yet when this mortal task of animal existence has been accomplished, a miraculous independence of soul is often evinced in the dying moments of pious individuals, where the most sublime ideas, purely intellectual, are exhibited, although every

SECTION OF THE BRAIN, PLATE II. Fig. 3d & 4th.

This forms an attempt at viewing the various parts of the brain as through a transparent medium, respecting its containing bones. It seems not sufficient to the inquisitive mind, that we are acquainted with the bones which contain the brain, as well as the parts and nerves of that complicated organ; their relations to each other ought to help us to detect, by external and familiar marks, those objects hidden from our view, that we may be prepared to fortell the event of injuries. From an accurate knowledge in this respect, the correct anatomist, in the day of battle, or other unfortunate occurrences, may ascertain the influence of wounds, and place physiology on a more stable footing than it hitherto has been. Wounds of the cerebrum affect the powers of the mind, while the living functions occasionally to a certain extent continue unimpaired. Sudden wounds of the cerebellum, on the contrary, are supposed fatal; yet we find insidious disease often destroying this last organ with impunity to life and intellectual exertion. A little attention to (Plate II. Fig. 3d and 4th) may lead at least to direct practitioners to minutiæ.

Preliminary Notion.

In Fig. 4th, the outline of the skeleton is represented on the left side, that the student may the more aptly transfer his notions from the bones to the muscles represented on the right, which cover the orbit and face. In Fig. 3d, the relations of the bones and parts of the brain contained, I hope may be easily comprehended.

Description of Fig. 4th.

(a) Falx, (b) superior longitudinal sinus, (c) inferior longitudinal sinus, (d) torcular, (e) tentorium, (f) lateral sinus, (g) pituitary gland, (h) ossa cuneiformia of the os sphenoides and occipitis, (*) lower portions of the vertical walls of the hemispheres, (i) corpus

corporeal agent has relinquished its power—when every organ, according to our apprehension, must retard and eclipse mental operation: A proof of the inscrutable and immortal nature of the human mind, operating independent of every physical law, so far as life, organs, actions, or those sensations and reflections are concerned, on which we so fondly place our delusive hopes and expectations in the heedless moment of energy. Do these facts entitle us to distinguish between intellectual ideas, dependent on sensation, and hence subject to change, and ideas purely intellectual, and of an immutable character?

callosum, (k) relative situation of the corpus striatum in dots, (l) septum luciduin, (m) fornix, (n) hippocampus minor, (o) hippocampus major, (p) thalamus nervi optici, (q) pons Varolii, (r) nates, above which is the glandula pinealis, and beneath is the testes, (s) the iter ad infundibulum, (p) third ventricle, (r) the iter ad quartum ventriculum, (a *e*) anterior lobes of the cerebrum in their highest portion, (q e g h q) middle lobe, (r e d e f e) posterior lobe, (e e f t f) cerebellum, (x) site of the medulla spinalis.

Description of Muscles, Fig. 3d, & 4th.

(a) Sphincter oris, (b) levator labii superioris alæque nasi, (c) levator anguli oris, (d) zogomaticus, (e) buccinator, (f) depressor anguli oris, (g) depressor labii inferioris, (h) masseter, (i) sphincter occuli, (m) temporalis, (k) frontal muscle.

By attending to Fig. 4th, not only are the contained parts of the brain easily transferred to the containing bones, in a practical sense; but this can be extended to the front view, Fig. 3d, which is exactly on the same plane. A wound inflicted on the forehead, (p) is nearly in a line with the corpus callosum: above it is the hemispheres, (r) the ventricles, (s) the hemispheres, (t) the middle lobe of the brain, (u) the pons Varolii and cerebellum, (v) the spinal marrow. By attending to the finished cranial bones (Plate III. Fig, 1st, Plate II. Fig. 3d) where the oviform cavity is distinguished from the facial outline, a very near approach may be made in forming an idea of the vessels, nerves, muscles, and that line which separates between the brain and face. The posterior curved margin of the os malæ and the zygoma, (Plate II. Fig. 4th, a), nearly forms a definition of the middle lobe of the brain; and if the student attentively surveys a skull, he will find that the optic nerve is placed nearly opposite to g, Fig. 4th. A ball would here wound the temporal muscle, its vessels and nerves, the os squamosum, the middle lobe of the cerebrum, before it touches the optic nerve. A ball penetrating the meatus auditorius externus (Plate II. Fig. 4th. e), wounds the pons Varolii, &c[1].

[1] When we contemplate the laws of bodies in motion, connected with parts so variously modified as the cranium and its contents, we cannot presume to say precisely what exact

Conclusion.

Youth, naturally generous, yet uncontaminated by the cares, the wants, and folly of life, will, I trust, accept these labours as a mark of my solicitude for their success in a profession of the most responsible nature. From a deficiency in accurate anatomy, the fruits of an honourable and attentive life in other respects, in the physician or surgeon, may be blasted in one unforeseen occurrence; of which I have witnessed numerous instances.

I have thought it my duty, as an anatomist, to offer such notions as seem to place life and matter, the work and gift of God, as well as immortal being, in what has appeared to me their true and connected light; as the notions on these subjects which have become too prevalent, seem equally erroneous, and dangerous to civilized life. It seems now high time, that every science, and every art, should unite in stemming the current of irreligion; which, under the mask of philosophy, and liberality of mind, offers an insult to common sense, and every true philosophic test, and threatens to undermine all those moral and religious principles, which compose the basis and the honour of human nature.

If, in investigating a subject so complicated, I have inadvertently expressed myself in terms which may be explained to a different purpose by the advocates of the doctrines which I deprecate, I still must indulge the hope, that, from the general scope of the facts which I have detailed, and the conclusions which I have drawn from these, my meaning can scarcely be mistaken. And, if I have failed to impress the mind of the reader of these pages with the peculiar ideas which have occurred to me on the subject, I yet trust, that no one who seriously investigates the structure and economy of a frame "so fearfully and wonderfully "made,"—since he must be convinced that an animal body is a

parts may be wounded, when a ball has entered the substance of the brain; the first portions affected may, however, be correctly ascertained, and if the exit of bodies are marked, even the contents injured may be nearly determined.

congeries of living apparatus, actuated by an immaterial and immortal essence,—can fail to be struck with veneration for the wisdom, the power, and the beneficence of that Being by whom it was formed, and by whom it is preserved.

THE END.

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ERRATA.

Page 43, line 21, *for* Plate X. *read* Plate XII.
line 22, *for* Plate XI. *read* Plate XIII.
line 24, *for* Plate X. *read* Plate XII.
63, line 20, *for* Fig. 4th. *read* Fig. 3d.
line 23, *for* Fig. 3d. *read* Fig. 4th.